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U. S. ARMY LAND WARFARE LABORATORY.
VOLUME II. APPENDIX B. TASK SHEETS

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PREFACE

This project was performed by Battelle's Columbus Laboratories (BCL) for the U. S. Army Land Warfare Laboratory (LWL), Aberdeen Proving Ground, Maryland, under Contract No. DAAD05-74-C-0771. Mr. P. M. Anderson of LWL was the Technical Monitor, and Mr. J. Tuck Brown of BCL was the Program Director.

Battelle wishes to express its appreciation to Mr. Anderson for his contributions to this Final Project Report on LWL. Due to his lengthy association with LWL and his interest in setting down for the record a full accounting of the U. S. Army Land Warfare Laboratory, Mr. Anderson provided invaluable assistance to the BCL researchers in the gathering of their documentation, recalling from his own experiences information necessary to complete the report. The comments and assistance of Col. Richard L. Clarkson and Dr. Russell D. Shelton, Commanding Officer and Technical Director during LWL's final years, were also vital in assuring the completeness and accuracy of this document.

The Final Project Report has been divided into two volumes:

Volume I. Project Report and Appendix A, Documentation

Volume II. Appendix B, Task Sheets

DISCLAIMER

The findings in this report are not to be construed as an official Department of the Army position. Neither does the citation of any items by trade name constitute official endorsement or approval by the Department of the Army of the use of such commercial items.

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| *08-S-73 | Insulated Case for Water Can | - - |
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APPLIED CHEMISTRY BRANCH

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APPLIED PHYSICS BRANCH

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APPLIED PHYSICS BRANCH (CONTINUED)

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BIOLOGICAL SCIENCES BRANCH (CONTINUED)

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RESEARCH ANALYSIS BRANCH

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SPECIAL ACTIVITIES DIVISION

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TECHNICAL SUPPORT DIVISION

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FINAL PROJECT REPORT -
U. S. ARMY LAND WARFARE LABORATORY
Volume II Appendix B. Task Sheets

INTRODUCTION

This Appendix contains complete descriptions of most of the R&D tasks performed by LWL during its 12 years of existence. (A listing of GNI tasks is included in Appendix A as Exhibit 18.) A listing of all tasks, grouped by Branch, appears on pages iii through xvii. The individual task sheets give the task number, title, level of funding, inclusive performance dates, major contractors (where such information was readily available), and a description and results of the work performed. These sheets are arranged in the same order as the preceding task listing, and the only tasks not included (identified by an asterisk on the listing) are those that were terminated for various reasons after they were funded but before any substantive results were achieved.

It should be noted, that although the duration of many of these tasks was from 3 to 5 years, this does not necessarily indicate that LWL was not fulfilling its quick-reaction mission. While LWL did not attain the 18-month goal in 100 percent of its task efforts, for most of the tasks there were positive results attained within 18 months, and then work was continued to (a) improve the item, (b) continue other phases of the task, in various subtasks, or (c) perform related studies that arose during performance of the initial task. In many cases, tasks were left open for administrative purposes for some time after the actual work was completed. This, of course, ties in with the discussion in the body of the report regarding the difficulty experienced by LWL in determining when a task should be terminated, and some tasks were undoubtedly carried on further than was warranted.

To summarize, of the 579 completed tasks for which sheets are included, 289, or 50 percent, were completed within 18 months, and another 93, or a total of 66 percent, within 24 months. Only 75, or 13 percent, were carried beyond 3 years. Of the 38 tasks included that were still open when LWL was discontinued, 18 had been active less than 18 months and another 13 less than 24 months. Those tasks that were still open were assigned to other laboratories.

TASK NUMBER: 01-E-63

TITLE: Drop Zone Locator

AUTHORIZED FUNDING: \$412,844

TASK DURATION: 11 December 1962 to 3 February 1966

CONTRACTORS: Simmonds Precision; Matrix

DESCRIPTION AND RESULTS: Provide a lightweight, man-portable position-marker beacon to be used by aviation or other elements of the Field Army to establish landing and drop zones. In Special Warfare operations, it will be used as both a drop and landing zone terminal navigation aid to assist in the delivery of personnel, equipment and supplies.

Transmitting set, Radio AN/PRT-7 (SLW-1&2), developed by the U. S. Army Limited War Laboratory, is a radio navigation aid beacon consisting of a transmitter, rechargeable battery, antenna system and carrying case. It is operated in the 200-400 KC band with a signal strength sufficient for an aircraft with ADF to track from 35 miles range at an altitude of 500 feet. This distance increases considerably at higher altitudes and over water. The equipment in march order weighs 23 pounds with a longest dimension of 15 inches. Frequency is controlled by a small plug-in type synthesizer, or 10 internal crystals. A Rectifier Power Supply is also provided to power the beacon at low temperatures or charge batteries from AC lines. Ten developmental systems were delivered for evaluation by USATECOM in a tri-service test with Air Force and Marine Corps beacons.

The AN/PRT-7 was comparatively evaluated with three other beacons (AN/TRN-19), AN/TRN-20, 11900), each having been designed for the same general purpose. The results of this test indicated that none of the beacons tested met a sufficient number of the SDR requirements to be considered suitable for military use. It was recommended that if an urgent requirement exists for an interim Portable Navigation Aid, Beacon Model 11900 be modified to correct the deficiencies and as many of the shortcomings as possible and that the resultant model be service tested.

TASK NUMBER: 04-E-63

TITLE: HF Radio for Jungle Use

AUTHORIZED FUNDING: \$214,073

TASK DURATION: 11 December 1962 to 27 August 1965

CONTRACTORS: Delco Division, General Motors

DESCRIPTION AND RESULTS: Develop a HF radio to provide communications for long range infantry patrols engaged in jungle warfare or counterinsurgency operations. The radio is required to be lightweight, compact, rugged, and easily operated for use by foot-mobile units under severe environmental conditions. A radio set designated AN/PRC-64 was developed.

The Radio Set AN/PRC-64 is a high frequency, four channel, crystal controlled, battery operated radio in the 2 to 6 megacycle band. The total weight of the radio is approximately 10 pounds. This weight includes a spare battery. Total battery life is estimated at 20 days on normal patrol usage.

It is equipped with a 500 cycle band pass filter for improved CW performance, and has a "whisper mode" for use during voice transmissions in tactical situations in the jungle. It also has a battery condition indicator, an antenna tuning indicator, and provisions for use of the A/N GRA-71 burst keyer. With an 8 watt output, this radio's performance generally equals that of older sets weighing 45 pounds at ranges to 300 kilometers.

One hundred and fifty-nine AN/PRC-64's were shipped to Vietnam in December 1965.

TASK NUMBER: 05-E-63

TITLE: Tactical Radio Antenna

AUTHORIZED FUNDING: \$218,141

TASK DURATION: 11 December 1962 to 1 April 1966

CONTRACTOR: CHU Associates

DESCRIPTION AND RESULTS: This task was initiated to produce a variety of antennas which offer tactical advantages over those which have been previously available. The efforts included antennas in the VHF, HF and LF ranges. Quite a number of antennas were designed, constructed and tested; both in-house and by contractors. Although only two types of the resulting antennas actually reached the field, considerable know-how in the way of materials, techniques and limitations was gained.

Antenna types studied included, but were not limited to, dipole arrays, loaded whips, loops (folding, wire, and rigid), helical, ground plane, ferrite, and inflatable, metalized plastic. In the investigation of these, several ideas were generated which were pursued under separate tasks. These involved ferrites and phased multiple loops. Also, a plastic artificial ground plane was tested in conjunction with some of the experimental helical monopoles, since these antennas were found to be very effective, provided their ground plane was adequate. One of the loop antennas, together with its matching section, was integrated into a lightweight transceiver which is currently under development.

Two very promising designs evolved as a result of in-house efforts. Both of these are loop antennas and both employ efficient capacitive-type matching networks. One is intended for vehicles and base station use. The other is a very lightweight, man-carried device for patrol use.

TASK NUMBER: 07-E-63

TITLE: Noiseless Communication Device

AUTHORIZED FUNDING: \$30,310

TASK DURATION: 12 March 1963 to 16 May 1966

CONTRACTOR: American Electronics Laboratories

DESCRIPTION AND RESULTS: The purpose of this task was to design and develop feasibility models of an ultrasonic communication system to provide a noiseless signaling capability over short ranges among members of a patrol where visual signaling is impossible. The system was to be sufficiently small and lightweight so as not to hinder the patrol members in the accomplishment of their mission nor limit their movability.

This ultrasonic device is an acoustical transceiver system. It consists of primarily transmitting and receiving modulated ultrasonic acoustical waves (23 kc). The package weighs 1-1/2 pounds and is 27 cubic inches in volume. The demodulated signal is used to activate a vibrator, in lieu of earphones, located on the user. A predetermined code to satisfy such basic commands as alert, proceed, assemble, and others is required.

Two prototype units were built under contract and tested in-house; results indicated that usable ranges of 40 to 175 feet depending on terrain could be obtained. Further development was required to decrease the false alarm rate in the item. Since no formal military requirement for a device of this type existed, the work on this task was terminated.

TASK NUMBER: 08-E-63

TITLE: Captive Balloon Borne Communications

AUTHORIZED FUNDING: \$197,092

TASK DURATION: 12 March 1963 to 27 August 1965

DESCRIPTION AND RESULTS: In response to a recommendation by a USACDC-sponsored conference on Jungle Communications Problems, LWL was directed to develop a captive balloon system for elevating a VHF radio or a radio antenna to reduce the high attenuation of VHF radio signals by jungle foliage. The system developed jointly by LWL and a contractor consisted of the following:

Balloon - 400 cu. ft. volume, having a static life of approximately eight pounds and capable of being launched in wind speeds up to 30 knots.

Transmission System - The balloon, held captive by a nylon tether line and associated reel units, elevates a dipole antenna and feeder line. A ground VHF radio such as the AN/VRC-10, provides power to the antenna.

Support Equipment - Ground equipment consists of two RL 31 reel units, a hydrogen gas generator with hoses, ground stakes, ground tarpaulins, and calcium hydride charges. Sixteen charges are required to fill the balloon. One charge will replace any gas leakage during a 24-hour period.

Five systems were tested in Vietnam with satisfactory performance; VHF ranges up to 50 km being obtained. However, since use of the system posed certain logistic problems, possible hazards to low flying aircraft and revelation of one's position, it was felt that no further effort was warranted. Accordingly, the task was terminated in August 1965.

TASK NUMBER: 01-E-65

TITLE: Narrow Bandwidth Systems

AUTHORIZED FUNDING: \$97,307

TASK DURATION: 3 August 1964 to 4 December 1967

CONTRACTOR: American Electronics Laboratories

DESCRIPTION AND RESULTS: The Narrow Bandwidth System is an exceptionally light-weight (8 ounces), compact, high frequency morse transceiver. Four preset, crystal controlled frequencies will operate in the 2-8 mc band. This system, in conjunction with a highly sensitive base station receiver will be capable of transmitting a CW signal over several hundred miles using a transmitted power of approximately 50 milliwatts.

The principal element of the system developed by LWL is an HF receiver featuring a bandwidth of only 20 Hz. This unusually narrow bandwidth gives the receiver the ability to detect extremely weak CW or Morse signals. This special receiver is intended to be operated at a base station where powerful transmitters and efficient antennas are available. Patrols in the field, clandestine operators or downed aviators may carry the new portable transceiver which may vary from slightly larger to considerably smaller than a large pack of cigarettes.

Developmental equipment was delivered and tested. In several aspects, it proved to be somewhat questionable. Nevertheless, good communications were consistently demonstrated over a wide variety of ranges (up to 60 miles) with marginal communications being provided at a range of about 200 miles. Tests indicated that one, or at the most, two carrier frequencies are sufficient. In addition, excellent communications were provided over a range of about 1.5 miles using the 100 milliwatt transmitter driving a 1/2 cubic inch coil as an antenna. Greater ranges were not attempted under these circumstances.

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TASK NUMBER: 02-E-65

TITLE: Thermoelectric Generators

AUTHORIZED FUNDING: \$71

TASK DURATION: 3 August 1964 to 22 March 1965

DESCRIPTION AND RESULTS: Under this task, LWL Task 03-E-63, Thermoelectric Battery Charger, was reactivated on the basis of improvements in the state-of-the-art reported by industry. A unit using boiling water as the heat rejection system was promised which produced 15 watts and weighed only 5 pounds, excluding the water. On investigation, by way of prototype, the weight was found to be 15 pounds with only minor reduction of this weight foreseeable. As there was no firm military requirement for the item, the investigation was discontinued.

TASK NUMBER: 03-E-65

TITLE: Telephone Amplifier

AUTHORIZED FUNDING: \$2,743

TASK DURATION: 3 August 1964 to 22 March 1965

DESCRIPTION AND RESULTS: This task was initiated in response to a requirement expressed by the 25th Infantry Division. It called for development of an amplifier to provide loudspeaker reception from standard field telephones, as in relaying fire orders to a gun crew or relieving operator fatigue during long listening periods. A prototype system was developed in-house and engineering models were being designed by a contractor when the requirement was cancelled by the 25th Infantry Division.

TASK NUMBER: 04-E-65

TITLE: Microwave Beacon

AUTHORIZED FUNDING: \$402

TASK DURATION: 3 August 1964 to 22 March 1965

DESCRIPTION AND RESULTS: The requirement for a microwave beacon to augment the existing LF Beacon or Drop Zone Locator was established when it was found that the accuracy requirement for the LF Beacon (75 meter radius) would be difficult to meet under all conditions. The microwave beacon concept was to use a specially designed (solid-state, low-power, 5-pound) radar, which would sense the incoming aircraft in its relatively narrow beam. At this point, the microwave beacon would cause the LF beacon to transmit a distinctive signal to the plane through the existing ADF, indicating station passage. Two advantages of such a beacon would be: (a) great accuracy, and (b) no additional aircraft equipment. The project was terminated when inquiry of a number of military units and pilots disclosed that 75 - 100 meter accuracy would be sufficient.

TASK NUMBER: 11-E-65

TITLE: Single Frequency Repeater

DESCRIPTION AND RESULTS: This development task was performed at the request of ARPA. The repeater is a device designed to accept a weak radio signal, such as from a patrol radio, and rebroadcast its information content on the same frequency at higher power. This is done by alternately switching on a receiver and a transmitter at a rapid rate, the received information being stored during the transmitter "off" period and then retransmitted. The transmitter is automatically held in a standby condition until a signal is received to conserve battery life. Five prototype units were built under contract.

TASK NUMBER: 01-E-66

TITLE: Speech Clipping

AUTHORIZED FUNDING: \$68,219

TASK DURATION: 4 October 1965 to 14 February 1968

CONTRACTOR: Philco-Ford

DESCRIPTION AND RESULTS: The purpose of this task was to determine if speech could be processed, reducing its bandwidth to a point where appreciable transmitter power could be saved (or the effective range correspondingly increased). The particular method of speech processing chosen consists of channeling the incoming speech through three adjacent bandpass filters, each approximately one octave wide and infinitely clipping the individual speech channels. The processor also contains a pitch extractor and a detector to determine if the incoming information bit is voiced or unvoiced. The information from the various channels is time multiplexed for pulse amplitude modulation of the single-sideband-suppressed carrier (SSBSC) transmitter. It was possible to compress the speech bandwidth to 550 Hz (700 Hz at the 6 db points). Synthesis of the speech is performed in the speech deprocessor. Two feasibility models were developed and tested. The test results proved the performance of the system to be somewhat short of the expected level in regard to speech quality and intelligibility.

TASK NUMBER: 03-E-66

TITLE: Pilot's Inertial Microphone

AUTHORIZED FUNDING: \$32,498

TASK DURATION: 8 September 1965 to 10 February 1967

DESCRIPTION AND RESULTS: This microphone system was developed specifically to overcome unsatisfactory operation of existing intercom systems as in the UH-1 and CH-47 aircraft under high noise conditions. The system consists of a light-weight bone conduction-type microphone installed inside the top of an APH-5 pilot's helmet and mounted in the manner to pick up voice vibrations through the skull. To provide adequate interface with existing IC box configurations such as the SB329 and the 1611, a small battery powered preamplifier is used. The installation of the microphone and amplifier make use of the present wiring within the aircraft.

Eight systems were sent to Vietnam in April 1966, and evaluated by ACTIV. Although the system did not provide communications between door gunner and pilot of the helicopter, it was not accepted because of the nasal tone quality and need for adjustment to work with locally modified intercommunication systems.

TASK NUMBER: 04-E-66

TITLE: Speech Bandwidth Compression

AUTHORIZED FUNDING: \$1,909

TASK DURATION: 20 October 1965 to 15 June 1967

DESCRIPTION AND RESULTS: An add-on device to accompany the Narrow Bandwith System, 2-1/4" x 5" by 9-3/4", weighing 8-1/4 lbs. was designed to reduce the bandwith required for speech transmission, with attendant improvement of range or saving in battery requirements. The trade off in bandwith would be at a sacrifice of real time, using a two speed tape recorder with a fast record and slow play-back into the transmitter.

One feasibility model of the system was obtained under contract DA-18-001-AMC-799(X). Although the concept is theoretically sound, practical design problems associated principally with the small size and weight required for field application nullify the effectiveness of the device. The major problems involve high gain required for the slow tape speed, mechanical difficulty in obtaining accurate speeds at the required ratio of 30:1, and electrical noise from the motors in close proximity to the amplifier circuits.

TASK NUMBER: 05-E-66

TITLE: Surveillance Transmitter

AUTHORIZED FUNDING: \$259,390

TASK DURATION: 18 November 1965 to 9 January 1968

CONTRACTOR: Sylvania Electric Products

DESCRIPTION AND RESULTS: The system developed consists of a single-channel, crystal controlled FM modulated transmitter designed to operate in the compatible frequency range of the AN/PRC-25 radio set between 48 and 76 MHz with an average RF power output of 2 watts. A small battery pack composed of silver cells and a large battery pack consisting of mercury-type batteries make up the two power sources. The system is designed to operate for either a 12-hour or 48-hour period at a 20:1 (Receive-Transmit) duty cycle depending on which battery pack is used. The size and weight of the small battery pack configuration is approximately 16 cu in and 14 oz, respectively, while the larger system is roughly four times as large. The radio range under average conditions should exceed 8 miles, and the microphone will pick up normal conversation at 50 feet in quiet surroundings.

Ten sets of equipment for evaluation were obtained under Contract DA-18-001-AMC-1980(X). Evaluation of the equipment was performed at LWL and at the Ranger Training Area at Eglin Air Force Base. Ten sets of equipment were taken to Vietnam 25 Sep 68 for demonstration, test and evaluation. USAECOM has been designated as the parent agency.

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TASK NUMBER: 06-E-66

TITLE: Surveyor

AUTHORIZED FUNDING: \$269,772

TASK DURATION: 3 January 1966 to 19 April 1967

CONTRACTOR: Sylvania Electric Products

DESCRIPTION AND RESULTS: The description of this item is classified SECRET. Ten units were shipped to Vietnam for evaluation in November 1966.

TASK NUMBER: 07-E-66

TITLE: Tunnel Kit

AUTHORIZED FUNDING: \$24,100

TASK DURATION: 5 May 1966 to 16 November 1966

DESCRIPTION AND RESULTS: Six kits were developed, tested at USALWL, and shipped to RVN, 6 Aug 66. An evaluation report was submitted by ACTIV, dated 6 Jan 67. Reception of kit was generally favorable, but a number of changes were recommended.

TASK NUMBER: 08-E-66

TITLE: Rifle Radio

AUTHORIZED FUNDING: \$6,829

TASK DURATION: 20 June 1966 to 10 February 1967

DESCRIPTION AND RESULTS: This item was to have been a transceiver, compatible with the squad radios, concealed in the stock of an AR-16 rifle. It was to have looked exactly like (i.e., no antenna or protuberances for battery compartments) a normal rifle. It was intended for use by the point of a patrol, or by selected riflemen who would not be required to release any grip on their rifle in order to communicate. An operating model was modified from a tone only device procured by ARPA on a 1963 contract. A specification for a contract was prepared. The task was discontinued on recommendation of CG, USARV, 1 Feb 67.

TASK NUMBER: 01-E-67

TITLE: Mine Firing Switch MFS-X1

AUTHORIZED FUNDING: \$24,450

TASK DURATION: 1 August 1966 to 27 November 1967

DESCRIPTION AND RESULTS: This is a multi-position switch and battery power source for selection and multiple detonation of up to ten M18A1 (Claymore) mines by one operator. It contains standard BA30 dry cells for an internal power source and a plug to accept the M-57 Firing Device in the event that batteries are dead or unavailable. There are ten electrical connectors to accept the Claymore firing leads and ten selector switches mounted in the cover.

On the bottom panel are arming and firing switches and a battery test circuit. The device is compatible with the present electrical circuitry of the M18A1 mine and the circuit tester provided with this mine. The entire switch system is contained in a waterproof, shockproof transit case.

Fifteen switches were tested and evaluated by ACTIV in Sep 67 and found suitable for use in SEA. ACTIV recommended minor changes and procurement of operational quantities. USAMUCOM, Picatinny Arsenal, was designated as the parent agency.

TASK NUMBER: 02-E-67

TITLE: Portable HF Antenna

AUTHORIZED FUNDING: \$26,234

TASK DURATION: 4 August 1966 to 18 December 1967

DESCRIPTION AND RESULTS: A square loop formed from teflon-coated wire constitutes the basic antenna. The center of the loop is suspended from one corner while light lines guy the two adjacent corners. Each side is approximately nine feet in length. An eight cubic inch sealed capacitor-type network provides an efficient match to conventional transmitter outputs and also provides tuning over the frequency range from 2 MHz to 8 MHz. It will have an effectiveness of 6 db or better over the AN-2 which was previously evaluated in Vietnam. The antenna, matching network, and a sectionalized pole will be supplied in a cloth carrying case with an approximate size of 15" x 4" x 4" weighing three lbs.

Ten evaluation models were shipped to Vietnam 25 Sep 67 at the request of ACTIV. USAECOM was the designated parent agency for this task.

TASK NUMBER: 04-E-67

TITLE: FM Demodulator

AUTHORIZED FUNDING: \$438

TASK DURATION: 3 August 1966 to 6 December 1966

DESCRIPTION AND RESULTS: The purpose of this task was to develop a new type FM demodulator for standard FM radio systems. The advantage of this system over conventional FM demodulators is the improvement of the threshold level in the presence of high ambient noise. The technique involved consists of a negative feed back FM demodulator system which is somewhat similar to a tracking filter whose bandwidth is substantially narrower than that required to transmit all of the FM components. The bandwidth being narrower will in turn result in greater noise immunity.

An investigation indicated that although 6 or 7 db improvement would be theoretically possible, in practice only 2 to 3 db can be achieved. As this improvement would be of questionable value in view of the extensive modification of receivers required to achieve it, the task was terminated.

TASK NUMBER: 05-E-67

TITLE: Site Marker Beacon

AUTHORIZED FUNDING: \$104,834

TASK DURATION: 3 August 1966 to 10 May 1971

DESCRIPTION AND RESULTS: The Site Marker Beacon consists of a pulsed VHF transmitter with an average power output of 1 watt. Power is provided to the transmitter by means of a battery pack made up of type E-133 Mallory mercury cells. To conserve battery life, the RF carrier is switching at a 50% duty cycle at a 7 kHz switching rate. The complete system is packaged within a standard 40mm smoke marker round and fired to the top of the jungle canopy by the M-79 grenade launcher system. Approximately one second after the firing, the electronic package separates from the main case, the beacon becomes activated, the antenna deploys and the system snags on the jungle canopy. The antenna system is made a part of the retaining line used to maintain the electronic package on the top of the canopy after system is fired and attempts to drop to the ground. The circuit is activated upon firing. A reliable homing range of 15 miles and a station passover accuracy of 100 meters regardless of the antenna's orientation can be obtained through the use of an aircraft equipped with an ARC-54 Radio Set and its associated ARA-56 homing device. The Mallory mercury battery pack will provide adequate power to operate the system for approximately 30 minutes to one hour.

Field tests conducted on the system at Fort Benning, Georgia, during Sep 70, revealed unreliable operational performance. As a result of this test, and a reexamination of the requirement situation, the task was cancelled.

TASK NUMBER: 06-E-67

TITLE: Transducer Study

AUTHORIZED FUNDING: \$14,729

TASK DURATION: 11 August 1966 to 18 June 1968

DESCRIPTION AND RESULTS: The study consisted of a literature search of various reports and contract proposals covering sensor specifications and performance characteristics and made a comparative evaluation to obtain an optimum system for area surveillance and intrusion detection. Experimental results obtained through scientific methods, as well as the results related by soldiers under typical operating conditions, were studied. Sensors investigated included magnetometers, acoustic, seismic and RF devices.

It was found that the intrusion detection range of all classes of sensors is severely limited as a result of the low signal-to-noise ratio caused by the relatively high ambient background noise and the small signal magnitude generated by the intruder's movement. The requirement that tactical sensor systems should be compact, causes the signal-to-noise ratio to become even worse and imposes greater limitations on applicable transducers. For a small area surveillance device, the seismic transducer offers the most promise.

TASK NUMBER: 07-E-67

TITLE: Ferrite Antennas

AUTHORIZED FUNDING: \$2,428

TASK DURATION: 4 August 1966 to 20 February 1967

DESCRIPTION AND RESULTS: The item sought under this investigation was an antenna whose major constituent would be a relatively small ferrite rod. It is a well known fact that such rods are excellent receiving antennas in broadcast radios, where the antenna length is less than 0.002 wavelength. It was hoped that recently developed ferrites would have improved loss characteristics which would enable them to be used in the transmitting mode.

After an investigation of the latest ferrites available from industry, it was found that the transmitting losses are still excessive. However, the experimental work on some ferrite samples showed that a modified ferrite antenna might be useful in obtaining a wide tuning range. In this application, the radiation is principally from dipole elements and the ferrite is used in the loading coil to electrically shorten the system. Further work was planned using this technique during work on Task 11-E-67.

TASK NUMBER: 08-E-67

TITLE: Communications for Tactile Sensors

AUTHORIZED FUNDING: \$2,473

TASK DURATION: 1 August 1966 to 18 November 1966

DESCRIPTION AND RESULTS: In order to provide silent communication from a squad leader to his men, the Human Resources Research Unit (HumRRO) of George Washington University, at Fort Benning, developed in the laboratory a language and a code which can be transmitted by electrical pulses to tactile sensors in a discrete pattern on a man's abdomen.

In reviewing HumRRO's work in detail, it was found that although the codes were developed, some training and response parameters established, and basic electrode and pulse types established, considerable research would be required before satisfactory electrodes and electronic package could be developed for field use. This work would have to precede the design of the communications link because of interface problems. It was felt that such a project would be too time consuming to fall within USALWL's mission.

TASK NUMBER: 09-E-67

TITLE: Landing Light System

AUTHORIZED FUNDING: \$74,330

TASK DURATION: 27 July 1966 to 2 August 1968

DESCRIPTION AND RESULTS: This system is a transportable, battery operated group of incandescent and strobe lights to mark landing strips and helicopter landing zones in counterinsurgency operations. All lights are waterproof. The landing lights contain both an incandescent bulb and strobe flashtube which, when the lights are cabled together, strobes sequentially or simultaneously. The runway marker lights are incandescent only. Different colored filters are supplied to fit over the lenses to designate threshold, guidance, parking, obstruction and taxiway. Each system is packed in a set of rugged reuseable carrying cases compartmented for the various components.

Six systems were procured; five for Vietnam and one for USALWL. Five systems were shipped in Mar 68 to ACTIV for test and evaluation. USAMEC, St. Louis, was designated as the parent agency.

TASK NUMBER: 10-E-67

TITLE: Retransmission Device

AUTHORIZED FUNDING: \$57,769

TASK DURATION: 7 March 1967 to 19 July 1968

CONTRACTOR: General Motors Corporation

DESCRIPTION AND RESULTS: This device, Control, Remote-Retransmission Unit C-7772(XLW-1)/GRC permits a unit commander using Radio Set AN/PRC-88 to remotely operate the units main tactical radio AN/PRC-25 or AN/VRC-12 and also to talk locally to his radio operator. This capability reduces the vulnerability of the commander and radio operator, as together they make a lucrative target. The device consists of a control module, one radio AN/PRC-88 and a BA399 installed in a case which is attached to the tactical radios. The device will also permit an artillery officer to talk on the field artillery intercommunications system from a remote position using an AN/PRC-88 radio. The device in this case controls a Remote Control Unit GRA-39 in the same manner as the tactical radio.

Six units were received and underwent engineering tests at the USALWL. These six units were shipped to ACTIV in 4th Qtr FY68 for test, demonstration, and evaluation.

TASK NUMBER: 11-E-67

TITLE: Improved VHF Antennas

AUTHORIZED FUNDING: \$1,154

TASK DURATION: 16 March 1967 to 29 September 1967

DESCRIPTION AND RESULTS: The concept of this device is based upon recent work accomplished under Ferrite Antennas which led to a compact ferrite-loaded dipole. This precedent has produced an antenna which provides an excellent match and efficient operation over the entire 30 to 75 MHz range. Tuning is accomplished by an integral contactor to the turns of the ferrite core coil. This type of assembly provides higher Q's than those which are obtainable from a moving core inductance. The higher Q and the resultant lower losses provide high efficiencies in relatively short configurations. No degradation in performance of system was apparent when operated close to the ground in a vertical position and coupled externally to the AN/PRC-25 Radio Set. Although it is not considered mechanically feasible for mounting on the AN/PRC-25, it will provide an adequate radiation system under conditions where there are no means of erecting a separate antenna. This task was terminated on the basis of no valid requirement.

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TASK NUMBER: 01-E-68

TITLE: Data Processing System

TASK DURATION: 3 August 1967 to 30 January 1969

DESCRIPTION AND RESULTS: The description and results of this task are classified
SECRET.

TASK NUMBER: 02-E-68

TITLE: Air Boat Communications

AUTHORIZED FUNDING: \$25,984

TASK DURATION: 11 August 1967 to 4 April 1968

DESCRIPTION AND RESULTS: Two air boats were completely equipped with the AN/VRC-12 transmitter-receivers, auxiliary receivers, audio amplifiers and inter-phone boxes. Combat vehicle communications helmets were fitted with face shields and provided at each of the five inter-communication stations. The driver's station was provided with a push-to-talk switch on the tiller lever. The existing 12 Volt power system in the boats was converted to 24 Volts to provide power for the communications system. Brackets for installing the equipment and the associated antennas were provided.

The two boats were tested extensively at the USALWL and at Eglin Air Force Base during Jan 68. The boats were shipped to Vietnam for evaluation tests in Feb 68. USAECOM was designated as the parent agency to supply Retro Fit Kits.

TASK NUMBER: 03-E-68

TITLE: Discreet Signalling System

AUTHORIZED FUNDING: \$190,367

TASK DURATION: 29 August 1967 to 23 April 1970

CONTRACTOR: Delco Radio Division, General Motors Corporation

DESCRIPTION AND RESULTS: ENSURE No. 188 stated the need for a radio device which is capable of being easily concealed and operated by indigenous personnel, and which could be used to transmit a signal to friendly forces to indicate that enemy forces were active in the area.

The system developed to meet this ENSURE consisted of three types of components, a relay, a base station, and a small transmitter. Activation is by means of a pushbutton associated directly with transmitter or a remote cabling system and when activated, each transmitter will send out a signal modulated by two discrete audio tones by which that transmitter can be identified. In order to reduce the size of the equipment and the length of its antenna, thereby making it easier to hide, the frequency band of operation was chosen as 148-174 MHz (high band).

One system comprised of 60 alarm transmitters, 11 relay units, and 2 base station decoder/display units was manufactured and delivered to the U. S. Army Limited War Laboratory. The equipment was field tested in Puerto Rico, November 1968, and again in March 1969. A system comprised of 40 alarm transmitters (30 operational and 10 substitutes), 6 relay units, and 2 decoder/display units was shipped to RVN 15 April 1969 for test and evaluation.

A system comprised of 52 alarm transmitters (40 operational, 12 substitutes), nine relay units, and two decoder/display units was evaluated in RVN and all equipment returned to USALWL mid-Jan 70. One system was provided for evaluation in the 4th Infantry Division Area of operation. The 4th Infantry Division found the system unsuitable but recommended further evaluation in other areas. USARV surveyed other commands for a requirement. None was identified. It was recommended by USARV ENSURE to be considered complete. The equipment was demonstrated to 8th Army personnel in Korea. Little interest was shown in the device itself unless it could be intimately connected to surveillance device. U. S. Army Electronics Command (ECOM) was the designated parent agency for this task.

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TASK NUMBER: 04-E-68

TITLE: Concealed Vehicular Antennas

AUTHORIZED FUNDING: \$8,061

TASK DURATION: 29 August 1967 to 24 September 1968

DESCRIPTION AND RESULTS: A concealed antenna was needed in the 30-76 mHz range for use on the jeep. Many possibilities were tested. The only one which functioned well was an assembly composed of several insulated concentric loops of copper tubing. These individual elements, by means of a switching arrangement, were selectable, individually and collectively, to provide a high L/C ratio throughout the entire band. It was planned that this antenna would be installed within the padding normally supplied on the back of a passenger seat.

An efficient, but uncovered prototype was developed. However, as a result of a reexamination of military need for this item, it was determined that there was no firm requirement and the task was cancelled.

TASK NUMBER: 05-E-68

TITLE: Elevated Radio Relay

AUTHORIZED FUNDING: \$39,609

TASK DURATION: 6 September 1967 to 10 February 1969

DESCRIPTION AND RESULTS: The unit is designed to be deployed on the jungle canopy by helicopter where it functions as an unattended VHF retransmission station providing a short term communication facility between two or more ground stations which would be unable to communicate otherwise. The item is intended to be deployed for relatively short periods only, the maximum life being 14 days. The life may be reduced substantially if a large amount of traffic is passed through the relay. The relay consists of a case in which two Radio Sets AN/PRC-25 are mounted together with a power supply consisting of a maximum of 24 batteries. The relay case measures 7 feet long by 18 inches high and 6 inches wide. From this case, extend 12 fiberglass rods, each 6 feet in length, and the two radio antennas. A nylon net approximately 18 feet long and 12 feet wide is attached to a cable which links the outer ends of the fiberglass rods providing the necessary support for the unit on the jungle canopy. Five models were fabricated and tested by U. S. Army Limited War Laboratory and five systems were sent to RVN in January 1969 for test and evaluation.

TASK NUMBER: 06-E-68

TITLE: Electronic Intrusion Detector

AUTHORIZED FUNDING: \$19,697

TASK DURATION: 11 September 1967 to 5 November 1968

DESCRIPTION AND RESULTS: This concept was based upon the principle that a change occurring in the vicinity of an antenna causes a reactive change in the antenna itself. Breadboard circuitry was devised which was successful in detecting changes in the phase of the antenna current as a function of intrusion within the principle portion of the antenna field. Using a transmitted power level of 1-1/2 watts and a commercially produced (TV Channel 13) Yagi-Uda antenna, the detection range for an erect adult human was about 100 feet. Although the results were encouraging, further efforts were required for a practical field system and the time required would have been too long for LWL's mission.

TASK NUMBER: 07-E-68

TITLE: Floating Landing Light

AUTHORIZED FUNDING: \$31,202

TASK DURATION: 26 October 1967 to 26 September 1968

DESCRIPTION AND RESULTS: The Floating Landing Light consists of the floating light proper with an under-slung wire case to hold the water-activated battery, an anchor and an adjustable mooring line. The floating light is composed of a lightweight housing with a float collar, a clear lens, snap-on type colored filters and a light mode selector switch. The flashing circuitry is contained in the housing.

Twenty lights were shipped to RVN in August 1968. An evaluation report received 26 Oct 68 indicated that, although light output, flashing mode, interchangeability of colored filters, floatability and the carrying cases were excellent, the lights were too bulky and too slow in activation time, and also that it was not necessary for the lights to float.

TASK NUMBER: 08-E-68

TITLE: Telescopic Mast for Erection by Helicopter or Compressed Air

AUTHORIZED FUNDING: \$11,696

TASK DURATION: 15 March 1968 to 13 November 1968

DESCRIPTION AND RESULTS: The mast was designed to provide a capability of supporting various communication and surveillance devices at heights up to a maximum of 200 feet. The design enables the mast to be raised and lowered in least practicable time using minimum manpower. The pilot model mast developed for engineering tests consists of 10 sections of round steel tubing, each 20 feet in length, varying in diameter from 1-1/2 through 6 inches, all sections being capable of telescoping from a maximum extended length of 200 feet to a collapsed length of 24 feet. It was designed for erection and lowering by use of helicopter or compressed air. Guy wires are used to support the assembled mast. Weight of the pilot model mast and accessories is 800 pounds.

One pilot model steel mast was fabricated. Design was also started on an aluminum mast having similar features to those described above, but weighing approximately 400 pounds.

TASK NUMBER: 09-E-68

TITLE: Market Search, Compact Voice Recorders

AUTHORIZED FUNDING: \$2,317

TASK DURATION: 27 March 1968 to 20 April 1968

DESCRIPTION AND RESULTS: The USALWL conducted a market search for a small commercially available compact voice recorder system weighing less than four pounds with a recording time of at least one hour, that will fit in the pocket of a flight suit and record both intercom and radio messages from existing Army aircraft intercommunication systems. The survey was completed and a response to the CRD letter was forwarded 22 Apr 68 recommending a short program to procure, modify and test two commercial recorders against the requirement.

TASK NUMBER: 10-E-68

TITLE: Tunnel Communications

AUTHORIZED FUNDING: \$1,492

TASK DURATION: 7 May 1968 to 10 October 1968

DESCRIPTION AND RESULTS: A means to provide a mode of communications via radio from a tunnel complex to above ground stations was desired. After testing various combinations of radio sets in the system, the following combinations were found to provide reasonably reliable communication from tunnel to surface:

- a. Above Ground - The AN/PRC-25 with long antenna.
- b. Below Ground - The PRT-4 Transmitter (part of the AN/PRC-88) with 5 watt amplifier attached.

A final report was written suggesting that a repackaging of the squad radio system be attempted for tunnel communications.

TASK NUMBER: 11-E-68

TITLE: Voice Recorder for Surveillance and Observation Aircraft

AUTHORIZED FUNDING: \$94,799

TASK DURATION: 3 June 1968 to 6 November 1972

DESCRIPTION AND RESULTS: A requirement existed for a small lightweight recorder which could fit into the pocket of a flight suit, and also be connected into the IC systems of aircraft to record radio and intercom conversations. The Sony 50, weighing approximately 1-1/2 pounds and recording up to an hour on a side, was the smallest practical recorder known for this application.

At a later date, this recorder was to be replaced by a lightweight Canadian recorder, which would be militarized, waterproofed, and would weigh approximately 2 pounds. It was expected to record 1/2 hour on each side and that its case would measure 7 inches x 5 inches x 2-3/8 inches.

The existing requirement called for the recorder to turn on automatically when there is voice present. A voice-operated switch was provided for this purpose.

TASK NUMBER: 01-E-69

TITLE: MFS Firing Range Extension

AUTHORIZED FUNDING: \$2,253

TASK DURATION: 3 July 1968 to 10 October 1968

DESCRIPTION AND RESULTS: The MFS-X1 range extension unit consists of an external battery box containing four BA-36 batteries connected in parallel by two copper bus bars. The container is a 5.65MM ammunition box with provisions made for the addition of an arming switch and an adaptor cable which can be connected to the "M57 IN" terminal of the MFS-X1. The necessary range extension is obtained by using WD-1 field wire in place of the 100 feet lengths of wire supplied with the M18A1 antipersonnel mines.

The range extension unit was designed and two prototypes fabricated. One of these, together with a data package, was submitted to the designated parent agency, Picatinny Arsenal. Picatinny Arsenal responded to an 8th Army ENSURE.

TASK NUMBER: 02-E-69

TITLE: Gunship II Evaluation

AUTHORIZED FUNDING: \$128,968

TASK DURATION: 15 July 1968 to 5 June 1970

DESCRIPTION AND RESULTS: The Motorola SST-181XS has been designated as the AN/UPN-34. It operates in the X-Band region. It has been repackaged into a case 9.2" wide, 5.5" deep, and 15" high, weighing approximately 15 pounds. When interrogated by a pulse from the radar in the gunship aircraft, it replies with coded pulses on an X-Band frequency displaced from the interrogator frequency by approximately 70 MHz.

In operation, the beacon is placed in a position where it may be "seen" by the aircraft. The forward observer then gives range and azimuth offset distance to the aircraft. This is the positional relationship of the target on which it is intended to place fire to the beacon. A computer in the aircraft uses this offset information and the information derived from the beacon reply to determine the proper orbit to be flown by the gunship in order that effective fire may be placed on the target.

The Miniponder is also an X-Band transponder. It is 5" x 3" x 1.6" in size and weighs 1.7 pounds. It works in an identical fashion to the UPN-34, but has much lower power and lower receiver sensitivity.

Eight each of the Miniponders and the AN/UPN-34 beacons were procured. In addition to these tests, field evaluation of offset firing accuracy (using surveyed position data) was conducted at Camp Atterbury, Indiana. It was found that under these conditions, that fire could be placed within 120 meters of the intended target. Evaluation of X-Band acquisition and lock on capability under a tropical forest environment was conducted in Puerto Rico. It was here found that the miniponder could not be relied upon for use in heavy tropical vegetation. However, the AN/UPN-34 performed satisfactorily.

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TASK NUMBER: 04-E-69

TITLE: Public Address Set AN/UIH-7

AUTHORIZED FUNDING: \$107,490

TASK DURATION: 21 August 1968 to 22 March 1971

DESCRIPTION AND RESULTS: Public Address Set AN/UIH-7 (V) consists of a battery capable of three hours continuous operation, a recorder reproducer with 30 minutes recording per side, one noise cancelling microphone with 25 feet of cable, and a control/amplifier/speaker unit. One unit can be mounted on the rucksack riveted frame and weighs approximately 30 pounds for carrying, and is air deliverable by parachutist. Mounting frames for four units will be provided for parallel operation when required for additional ground ranges up to 2,000 yards or 2,500 yards slant range from helicopters. The basic and multiple systems are all powered by 24 to 28V so that they may be operated either on self-contained batteries or vehicular or aircraft power.

Four units were delivered to USALWL and design work on a second generation prototype was progressing when it was decided to terminate all work on the AN/UIH-7 and commence a joint development with the Marine Corps based on the elements of the Marine Corps AN/UIQ-8 (Task 09-E-71). This change in direction came in Dec 70.

TASK NUMBER: 05-E-69

TITLE: Land Navigation Audio Compass

AUTHORIZED FUNDING: \$35,097

TASK DURATION: 21 August 1968 to 7 January 1970

CONTRACTOR: Johnston Laboratories Inc.

DESCRIPTION AND RESULTS: The Land Navigation Audio Compass is a device which enables the user to monitor the compass course continuously without sighting either the compass or a distant object.

The device consists of a two axis gimballed compass mechanism encased in a liquid filled container with an optical readout disc as well as a course setting azimuth card. It is packaged to allow the user to carry the device by means of a strap around the neck in the same way as a camera or binoculars. The audio output is provided to a small headphone. The device provides a null when "on course" and a tone which increases as the course error increases. Left or right of the desired course indications are of a different pitch. There is no ambiguity problem as both tones are present at 180° off course.

The project was cancelled because of problems encountered during environmental testing. It was determined during these tests that the jewels and pivots supporting the magnetic assembly could not withstand the vibration that might be expected in normal use. No solution to the degradation of the accuracy after test could be found within the constraints posed by the in-house military requirements. These in-house military requirements called for a compass which could be used in the aural mode as well as in a manner similar to that of the lensatic compass. An all electronic compass could be designed to meet the original problem, but not the visual sighting requirement imposed by the in-house military requirements.

TASK NUMBER: 06-E-69

TITLE: Electronic Regrouping Device

AUTHORIZED FUNDING: \$2,157

TASK DURATION: 20 August 1968 to 10 February 1969

DESCRIPTION AND RESULTS: Intended for use by paratroopers, it was planned that one man would be provided with a very compact, low-powered transmitter while all others would have a complementary Radio Direction Finding receiver. Immediately after a drop, all troops could reassemble at the site of the transmitter irrespective of terrain or lighting conditions. This project was discontinued due to problems in countermeasures and lack of interest in the field due to changing tactics.

TASK NUMBER: 07-E-69

TITLE: Collision Avoidance for Helicopter

AUTHORIZED FUNDING: \$9,642

TASK DURATION: 17 September 1968 to 26 June 1970

DESCRIPTION AND RESULTS: Prior art and systems under development, foreign and domestic, which will aid pilots in avoiding collision with other aircraft and can be adopted to U. S. Army helicopters were investigated. In addition, a self-powered nuclear light system was designed and developed to equip an UH-1D helicopter. This system is intended to aid helicopter pilots in keeping close flight formation during nights and reduce danger of collision with other aircraft. The self-powered nuclear light source consists of an assembly of approximately 20 individual radioluminescent light cells. The system appears to be feasible and could be developed based on the Proximity Warning Systems, if the additional weight and equipment could be tolerated.

TASK NUMBER: 08-E-69

TITLE: Illuminated Map Reader

AUTHORIZED FUNDING: \$12,172

TASK DURATION: 18 September 1968 to 13 November 1968

DESCRIPTION AND RESULTS: The Illuminated Map Reader was developed to replace the flashlight in reading maps at night. Since in addition to the flashlight, a magnifying glass is frequently required and blackout conditions must be observed, the handling of these items makes map reading cumbersome.

The Illuminated Map Reader consists of a magnifying glass, 1-1/2 inch in diameter, with a magnification factor of two, a retainer ring that includes the luminous ring of phosphor and a hinged lead lined sliding cover that serves as protector and radiation shield. The top of the cover has a ridged ring while the underside of the cover is smooth. The underside covers the luminescent ring.

The phosphorescent material is a dry, free-flowing powder which is activated by beta particles from the radioisotope Promethium-147 to which the phosphor is intimately bound with a binder. The luminescent material is applied in the form of a paint and is then sealed in a groove of the outer ring of the lens assembly. The binder is selected to have high radiation resistance and weatherability.

During operational tests, a secondary role for the map reader was discovered. It was found to be a useful aid at night as a guiding light, as an assembly point on dark nights, as a signal light and as a subdued light.

Several models were developed and underwent environmental testing and radiological evaluation. The results indicated that the map readers do not constitute a radiobiological health hazard to personnel. Twenty-five units were then manufactured and sent to RVN for evaluation under DA Radioactive Material Authorization A19-29-11 in Oct 69. The results of the evaluation as indicated by Headquarters, USARV indicated a high degree of user acceptability for the map reader, especially in its primary role. Headquarters, USARV, recommended that USACDC review the advantages of the device over standard flashlights, pen lights or other expedients that might justify extensive procurement of the map reader. The USAMECOM/MERDC was the designated parent agency for this item, and received preliminary technical data.

TASK NUMBER: 09-E-69

TITLE: Ambush Light

AUTHORIZED FUNDING: \$32,295

TASK DURATION: 9 January 1969 to 5 June 1970

DESCRIPTION AND RESULTS: The Ambush Light was designed to illuminate a kill zone set up by friendly ambush patrols in SEA. Remote switch operation is required to reduce casualties when fire is directed at the light.

The entire light assembly is contained in a standard, sealed 7.62 ammunition box. Total weight is about 15 pounds. This assembly includes 12 alkaline "D" cells capable of uninterrupted service for more than 15 minutes. A single sealed light will provide a beam 5° high by 40° wide. Intensity is sufficient to detect a man at a distance of 100 feet. The light may be quickly mounted on a tree using a light rucksack strap and saddle or it may be mounted directly on the ammo-box container. A ball-type swivel joint permits orientation in any direction. The control cable is 100 feet in length.

In-house fabrication of 28 lights was completed. Twenty-five were shipped to RVN on 1 Jun 70. Two demonstration models were shipped to Korea in May 70.

TASK NUMBER: 10-E-69

TITLE: Improved Retransmission Device

AUTHORIZED FUNDING: \$234,553

TASK DURATION: 14 February 1969 to 15 February 1972

CONTRACTOR: Delco Radio Division, General Motors Corporation

DESCRIPTION AND RESULTS: The original Remote-Retransmission Unit C-7772(XLW-1)/GRC consists of a control module, AN/PRR-9 Receiver, AN/PRT-4 Transmitter with separate receiving and transmitting antennas, and a BA-399 Battery installed in a case which attaches to the tactical radio sets AN/PRC-25 or to the AN/VRC-12. The Improved Remote-Retransmission Unit C-7772 (XLW-2)/GRC employs essentially the same design as the original system with exception that all components of the system are housed in a water-tight package.

This device permits a unit commander using Radio Set AN/PRR-9 Receiver and AN/PRT-4A Transmitter to remotely operate the units' main tactical radio AN/PRC-25 or AN/VRC-12 and also to talk locally to his radio operator. The device will also permit an artillery officer to talk on the field artillery intercommunications system from a remote position using an AN/PRR-9 Receiver and an AN/PRT-4A Transmitter.

Six Remote-Retransmission Units C-7772(XLW-1)/GRC were sent to RVN for evaluation in June 1968. The evaluation report indicated that the devices were inadequately constructed to withstand the normal rough handling by infantry units and environmental conditions of RVN; when the devices were evaluated by certain artillery units under administrative environmental conditions, they operated successfully and were well received. The U. S. Army Electronics Command was the designated Parent Agency for this item.

TASK NUMBER: 02-E-70

TITLE: Swimmer Detector

AUTHORIZED FUNDING: \$168,100

TASK DURATION: 31 December 1969 to 6 March 1973

DESCRIPTION AND RESULTS: The Directional Doppler Swimmer Detector HLSD-1 is a cw-Doppler sonar device jointly developed by the Harry Diamond Laboratory and the Land Warfare Laboratory. It includes automatic alarming and audible target recognition. The system has six channels, each with a ten degree of lateral coverage, so that a sector of 60° is being surveyed at all times. The system is designed for use in protection of bridges, docks or other sensitive areas located on or adjacent to waterways.

Tests conducted in March disclosed that improvements were required to the present system to suppress background noise. These changes were made to improve temperature stability and also to reduce the effects of supply voltage variations on the dc alarm circuit amplifiers. Tests conducted in October 1972 disclosed that the changes made improved the performance of the system but not sufficiently to meet Army requirements. It was concluded that further development of this system would not provide significant improvement.

TASK NUMBER: 03-E-70

TITLE: Skid Mounted Antenna

AUTHORIZED FUNDING: \$3,346

TASK DURATION: 13 April 1970 to 30 September 1970

DESCRIPTION AND RESULTS: The Skid Mounted Antenna was designed to provide additional communications to a helicopter by allowing the temporary installation of a PRC-25 or PRC-77 Radio. The antenna can be quickly installed or removed from the aircraft. The skid antenna is a modified long wire which is mounted between the skids of the UH-1. It is spring loaded and is fed by the long antenna terminal of an AN/PRC-77. The PRC-77's internal loading circuits tune it when frequencies are changed. The antenna is approximately 15 feet long and will out-perform the commonly used field expedient dipole antenna on 90% of the PRC-77 frequencies.

TASK NUMBER: 04-E-70

TITLE: Interpretaide Translator

AUTHORIZED FUNDING: \$3,209

TASK DURATION: 13 April 1970 to 1 February 1971

DESCRIPTION AND RESULTS: The Interpretaide Translator ADC-1 is a commercial item designed to assist the user in communicating with others using a language which is not common to both. It is basically a specially designed magnetic belt player having selectable pre-recorded phrases. Selection is made by number referenced to a printed card. It weighs approximately 2 lbs 10 ozs and measures 2-1/2 x 7-1/2 x 4-5/16 inches. Pre-recorded belts can be furnished in any language, and programmed in any order required.

TASK NUMBER: 01-E-71

TITLE: Quiet Operation of PRC-77 Radios

AUTHORIZED FUNDING: \$14,974

TASK DURATION: 17 July 1970 to 15 February 1972

CONTRACTOR: Electro-Voice Inc.

DESCRIPTIONS AND RESULTS: Two methods were developed to provide the whisper operation of the AN/PRC-77. The first of these consists of a small lightweight headset and microphone which is inaudible three feet away in a normal background, and which can be used to operate the AN/PRC-77 in place of the H-189 Handset. A normal speech/whisper switch is provided so that the headset can be used for normal operation. The headset uses an earplug type receiver and a microphone similar to those used by telephone operators. The microphone tube is inserted in a foam voice silencer which is strapped to the operator's mouth. The push-to-talk switch is supplied on a separate cable so that it can be operated while the operator is still holding a weapon. The second system consists simply of attachments of acoustic foam for the microphone and earphone of the H-189 Handset.

Ten headsets and a quantity of acoustic foam attachments were evaluated by the Florida Ranger Camp during Dec 71 and Jan 72. The test results indicated that both systems produced acceptable quiet voice mode of operation for the AN/PRC-77. The development of a hardened version of the lightweight headset and the selection of a more suitable foam material for the second system were recommended by the evaluating agency.

TASK NUMBER: 03-E-71

TITLE: Radio Relay Equipment

AUTHORIZED FUNDING: \$1,418

TASK DURATION: 16 August 1970 to 11 December 1970

DESCRIPTION AND RESULTS: The effort amounted to a study program to determine the feasibility of deploying and recovering a radio relay station composed of back-to-back AN/PRC-77 Radio Sets from the jungle canopy. As a method of extending the radio range of the Radio Set AN/PRC-77, a range of 100 km was selected as a design goal for the relay station.

Several design approaches to packaging the radio relay with self-contained power supply to last 30 days were generated. After a preliminary investigation, it was determined that a system deployed in even the tallest trees could not obtain the radio range specified; consequently, no hardware was developed, and the program was cancelled.

TASK NUMBER: 04-E-71

TITLE: Night Vision, Approach to Blacked-Out LZ

AUTHORIZED FUNDING: \$14,993

TASK DURATION: 11 August 1970 to 7 September 1971

DESCRIPTION AND RESULTS: A system was needed that would aid a pilot to land a helicopter in blacked-out landing zones for insertion of clandestine patrols without benefit of detailed aerial reconnaissance. A study program was initiated to determine the feasibility of using low light level TV's and wide angle night vision devices as possible means of solving the problem.

Discussions were held with pilots from the USALWL, from the Institute of Strategic Operations, Fort Bragg, N.C., and U.S. Army Aviation Agency, Fort Rucker, Alabama. Also contacted were U.S. Army Electronics Command, the Night Vision Laboratory, Human Engineering Laboratory of ARDC and Bell Helicopter Company.

USAECOM NVL was tasked by ARPA to develop a feasibility and demonstration model that directly addresses the night landing problem. NVL agreed to furnish LWL with copies of their reports.

TASK NUMBER: 05-E-71

TITLE: Position Marker and Secure Signal System

AUTHORIZED FUNDING: \$8,894

TASK DURATION: 11 August 1970 to 11 December 1970

DESCRIPTION AND RESULTS: It was intended to design and develop a system to covertly mark drop zone locations under adverse weather and terrain conditions. Design considerations were to develop a VHF radio system and also to include a flashing light source. Independent control of both systems would be maintained through a separate aircraft interrogation channel. Under normal operations the system would be air-dropped onto jungle canopy and operate only from command signals generated by aircraft radio equipment. To minimize additional development cost, maximum use of standard aircraft radio equipment was also considered. As design goals, the weight of the system was not to exceed 50 pounds including a self-contained power pack.

The requesting agency was advised by LWL to consider another approach which appeared to have greater merit than the one proposed. The After Action Report from the requesting agency directed LWL to discontinue the development; consequently, the task was terminated and no hardware resulted.

TASK NUMBER: 06-E-71

TITLE: Crash Locator Beacon

AUTHORIZED FUNDING: \$8,565

TASK DURATION: 11 August 1970 to 23 December 1971

DESCRIPTION AND RESULTS: A system to assist search aircraft to locate downed Army aircraft was required. The Crash Locator Beacon consists of pulsed transmitters operating at 40.5 MHz, 243 MHz and 121.5 MHz. The duty cycle was to be 30 seconds on and 60 seconds off. The device was to be turned on and/or deployed from the downed aircraft by the impact. It may also be actuated by the flight crew. Means of providing operation in Arctic environment as well as in the high temperatures encountered if the aircraft burns were investigated. The power output was to be sufficient to allow the search aircraft to "home" from a distance of 20 miles.

Procurement of Crash Locator Beacons for test and evaluation was initiated; however, satisfactory contractual arrangements could not be consummated and procurement action was withdrawn.

TASK NUMBER: 07-E-71

TITLE: Alarm System for Sensitive Devices

AUTHORIZED FUNDING: \$3,978

TASK DURATION: 25 August 1970 to 22 March 1971

DESCRIPTION AND RESULTS: Sensitive devices are subject to unpacking and/or removal from storage areas by unauthorized persons. An alarm system was required to alert guards and sentries if unauthorized tampering or moving of such devices occurs. The alarm system would alert the proper authorities of the unauthorized tampering of the protected devices. Local and remote alarms would be required. Provision would be made for the authorized opening and/or moving of the protected devices. A magnetic anti-disturbance device would be investigated.

After a comprehensive investigation, no firm requirements for such a device could be established. The task was therefore cancelled.

TASK NUMBER: 08-E-71

TITLE: Detection of Concealed Metal Objects

AUTHORIZED FUNDING: \$44,147

TASK DURATION: 6 October 1970 to 29 June 1972

DESCRIPTION AND RESULTS: Four types of commercial metal detectors were evaluated by LWL. These detectors were electronic search devices. In the case of all-metal, walk-through detectors, any metal passing through the opening disturbs an electromagnetic field. This change is detected and registered as visual and audio alarm signals. The ferrous-metal, walk-through detector is a magnetometer which senses disturbances in the earth's magnetic field caused by steel objects. It provides both visual and audio alarms. The hand-held all-metal detector operates on the same principle as the all-metal, walk-through units but must be brought within a few inches of small objects to detect them. It serves to locate hidden objects and thereby complements the walk-through units. USALWL tests demonstrated the technical feasibility of using such walk-through stations for the detection of ferrous and non-ferrous metals.

TASK NUMBER: 09-E-71

TITLE: Public Address Set AN/UIQ-10

AUTHORIZED FUNDING: \$118,231

TASK DURATION: 19 March 1971 to 27 February 1974

CONTRACTOR: Bendix Field Engineering Corporation

DESCRIPTION AND RESULTS: The AN/UIQ-10 consists of a basic unit, the AN/UIQ-11 and a Loudspeaker Assembly, LS-611/UIQ-10. Each unit is mounted on a rucksack frame. The basic unit, UIQ-11, consists of an amplifier, control box, battery, and single horn speaker. It weighs 35 pounds. The Loudspeaker Assembly, LS-611/UIQ-10, consists of three additional horn speakers and an auxiliary battery. It weighs 31 pounds. The basic unit can be operated independently for low power applications. For long range, helicopter-borne applications, two modified systems were developed. One simply substitutes a 300 watt highly efficient, directional horn loudspeaker for the four standard horns. A second version employs three UIQ-11 amplifiers to operate a 900 watt horn speaker. The basic UIQ-11 (single speaker) is rated at 65 watts and provides a range up to 1000 meters under quiet conditions. The four speaker UIQ-10 has a range up to 2000 meters. The airborne versions have longer ranges; the 900 watt system has provided ranges in excess of 3000 meters in ground tests. In a UH-1H helicopter good intelligibility was achieved from an altitude of 5000 feet at horizontal distances of 2000 meters.

Eight AN/UIQ-10 systems were evaluated by various units of the Fleet Marine Force, Atlantic. Recommendations of this evaluation were that the AN/UIQ-10 be adopted for Marine Corps use and that it be the basis for all future PA systems within the Marine Corps. Two AN/UIQ-10 systems were evaluated by the 8th PSYOPS BN at Ft. Bragg. Conclusion of this evaluation was that the AN/UIQ-10 is superior in many respects to other available Army public address sets. The results of the evaluations were provided to ECOM so that some of the features could be considered for possible inclusion in future Army systems, perhaps as product improvements in the AN/UIH-6 system.

TASK NUMBER: 01-E-72

TITLE: Emergency Arctic Battery

AUTHORIZED FUNDING: \$47,539

TASK DURATION: 9 August 1971 to 27 February 1974

DESCRIPTION AND RESULTS: This battery is designed to provide emergency power for Army tactical radios at extremely low temperatures where standard batteries fail. It is a one shot, thermal, inert electrolyte type, which is connected to the power jack J3 of the PRC-77 radio. To produce electrical power, a percussion primer is used to ignite a pyrotechnic mixture which instantly heats up the electrolyte material. Heat generated is retained by insulation in the battery. The entire battery is contained in a metal jacket to prevent endangering the operator.

Phase 2 of this task involved the development of a thermal battery for the AN/PRC-74 radio set which has operating characteristics similar to the battery developed for the AN/PRC-77.

One hundred and fifty PRC-77 batteries were built and fifty of these were evaluated in Alaska during Winter 1972-73. Twenty of the PRC-74 batteries were built and also evaluated in Alaska. Follow-on development was transferred to ECOM.

TASK NUMBER: 02-E-72

TITLE: Short Range Simultaneous Communication System

AUTHORIZED FUNDING: \$15,174

TASK DURATION: 10 August 1971 to 22 August 1973

DESCRIPTION AND RESULTS: The Simultaneous Communication System is based on a new technique of modulation for radio communications. This enables two or more transmitters to operate simultaneously on the same frequency without interference. The channel cannot be tied up by someone's holding his transmit switch on, and a transmission will not be garbled by the turning on of a second transmitter. As a result, the conventional push-to-talk switch can be eliminated.

The operation of the system is based on an FM pulse-modulation which is controlled not only by voice input, but by feedback from the receiver. Thus the pulses of two or more transmitters, while operating simultaneously, phase lock and do not interfere. It is this phase locking capability which permits the equipment to perform intrinsically as a relay system.

Four multicom radios, Bendix Model MC-457C were tested at LWL. The tests showed that the feasibility models had inadequate range (400-500 ft.) and were very poorly configured (headphones, microphone, antennas and cabling were clumsy and obtrusive). The manufacturer developed significantly improved models which were claimed to have ranges of 1/4 to 1/2 mile. However, even this range appeared to be too short for user requirements.

TASK NUMBER: 03-E-72

TITLE: Emergency Distress Signalling Device

AUTHORIZED FUNDING: \$179,895

TASK DURATION: 4 October 1971 to 27 February 1974

CONTRACTOR: Thiokol Chemical Corporation

DESCRIPTION AND RESULTS: This task involved the design and development of a radio alarm system to enable a patrol to transmit a distress signal when an emergency condition exists. The system consists of a special coded RF transmitter designed to be rocket launched to the desired altitude. The system is equipped with a retardation chute and a special battery (thermal). The rocket system is approximately 24 inches long and weighs about 2 lbs. The base station receiving equipment contains the necessary electronic circuits to produce both a visual and audio response upon receipt of the distress signal. Munitions Branch has provided all necessary support in the rocket development part of the system. The transmitter power output is sufficient to produce a reliable radio range of 50 miles at a rocket altitude of 5000 feet. Provisions have been made to automatically activate the thermal battery system at the time of rocket motor burn-out. The battery provides sufficient energy to operate the system for 60 seconds.

Feasibility testing under field conditions was successfully completed. Fifteen rocket systems were prepared for demonstration tests in Alaska (June 1973) and the system was turned over to a parent agency.

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TASK NUMBER: 04-E-72

TITLE: Airborne TV System

AUTHORIZED FUNDING: \$141.935

TASK DURATION: 24 February 1972 to 27 February 1974

DESCRIPTION AND RESULTS: The helicopter broadcast TV system consists of a commercially available video tape recorder, a 10 watt transmitter tuned to operate on Channel 12 (204-210MHz) and a modified cross dipole antenna system. The antenna is equipped with a 30 inch ground plane and fabricated for mounting on the underside of the UH-1H helicopter. The equipment is intended for use in support of psychological warfare operations.

Feasibility tests at Ft. Bragg were completed successfully. A 100 watt version of the existing 10 watt system was developed for CONUS testing and evaluation. The possibility of incorporating color capability was evaluated.

TASK NUMBER: 01-E-73

TITLE: Radio Telephone-Vox

AUTHORIZED FUNDING: \$46,422

TASK DURATION: 19 July 1972

DESCRIPTION AND RESULTS: The device is a telephone-radio interconnecting arrangement with automatic control provided by a voice operated switch (VOX). This alleviates the need for a dedicated operator.

The device weighs about 3 lbs and is approximately 3 x 4 x 10 inches. Terminals and cables are provided to allow for connection to telephone line and to tactical radios such as the AN/PRC-77 or the AN/VRC-12. Evaluation of the device was still in progress at the time of deactivation.

TASK NUMBER: 02-E-73

TITLE: Multishot Thermal Battery

AUTHORIZED FUNDING: \$88,122

TASK DURATION: 19 July 1972

CONTRACTOR: Catalyst Research Corporation

DESCRIPTION AND RESULTS: This task was designed to provide a thermal battery with multiple shot capability to power tactical radio equipment under Arctic weather conditions. An inert solid type electrolyte material was used in the construction of the battery. Application of an external heat source produced by a suitable fuel melts the electrolyte material and starts the generation of electrical power. Removal of the heat source deactivates the system.

The battery is designed to produce an output power of approximately 10 watts (15 volts @ 780 ma) for a period of two minutes for at least four different transmission intervals. System evaluation was in progress at the time of deactivation.

TASK NUMBER: 03-E-73

TITLE: Radio Retransmission System

AUTHORIZED FUNDING: \$73,307

TASK DURATION: 20 July 1972

DESCRIPTION AND RESULTS: The retransmission unit consists of a small transmitting and receiving unit with voice operated switches that attaches to the mobile transceiver of CONUS MP patrol cars. This is activated by a pocket-sized, self-powered transceiver that can be carried in the pocket or clipped to the belt. By this means, MP's are able to maintain communications with their headquarters without being required to remain at their vehicles.

The retransmission unit is easily attached or removed and does not interfere with the normal use of the radio nor does it require any modification to the CONUS MP patrol car radio equipment. Communications between a radio operator in a patrol car and his base station is not effected.

Four VHF systems, two each from the two contractors, were evaluated by the Military Police at APG. These were further evaluated by the MP's at Ft. Meade. VHF systems for Ft. Gordon were delivered in August 1973. Evaluation was still in progress at the time of deactivation.

TASK NUMBER: 04-E-73

TITLE: Analysis of the I-SPY System

AUTHORIZED FUNDING: \$111,237

TASK DURATION: 17 October 1972 to 28 February 1974

CONTRACTOR: Radiation Division of Harris-Intertype Corporation

DESCRIPTION AND RESULTS: Under this task the parameters and the feasibility of developing an artillery mounted, line-scan mapper were studied. Visual and infrared sensors were mounted in a 155mm projectile, looking out the side of the shell. When the shell is fired, its rotation causes the sensor to scan a line on the ground, while the forward motion of the shell causes each line to advance. The sensor's intensity signal telemeters back to the base station where a map is generated of the ground over which the projectile flies. The telemetered information generates a real-time map that is recorded for later and more detailed study.

Military characteristics for artillery target identification were established. Preliminary analysis showed that usable map pictures can be generated near the apogee of the trajectory and out to about 80% of the maximum range of the trajectory.

TASK NUMBER: 05-E-73

TITLE: Underwater Target Detector-Feasibility Study

AUTHORIZED FUNDING: \$43,568

TASK DURATION: 2 February 1973 to 29 January 1974

CONTRACTOR: Applied Research Laboratories

DESCRIPTION AND RESULTS: Tests of a Directional Sonar Swimmer Detector developed under Task 02-E-70 have shown that analog techniques employed in all existing sonars have severe limitations for Army applications. New approaches are needed to meet Army requirements for increased swimmer detection ranges and wider coverage. A feasibility analysis was conducted, under contract, to investigate new techniques and to identify any promising approaches.

The following characteristics were the most important requirements considered:

- a. Automatic alarm ranges of at least 200 meters.
- b. Lateral coverage to extend over 180°.
- c. Ability to perform satisfactorily under most normally encountered environmental effects resulting from changes in temperature, wind, and waterflow.

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TASK NUMBER: 06-E-73

TITLE: Cryogenic Cooling for Artillery-Launched Sensors

AUTHORIZED FUNDING: \$85,710

TASK DURATION: 8 February 1973

DESCRIPTION AND RESULTS: The objective of this task was to develop a cryogenic cooling system to provide cooling to an infrared detector for the artillery line scan system. The cryogenic cooler utilizes a Joule-Thompson cryostat to provide the cooling. The gas supply for this cryostat is contained in a pre-pressurized gas storage bottle. The setback forces upon firing the projectile turn on the gas to the cryostat and start the cooling cycle.

Candidate designs were obtained from three commercial suppliers of coolers. These were tested in an air gun for survivability and the successful units fired from a 155mm weapon. The task was still in progress upon termination.

TASK NUMBER: 01-E-74

TITLE: Combination Strobe-Flashlight

AUTHORIZED FUNDING: \$6,000

TASK DURATION: 13 August 1973 to 29 April 1974

DESCRIPTION AND RESULTS: The standard Army Flashlight, MX-991/U, does not meet the needs of the Rangers and other units involved in special operations. The required light must be pocket-shaped and sized, must have standard flashlight illumination capabilities and must provide a high intensity, flashing, strobe light for signalling.

A breast pocket-sized light which incorporates a high intensity, xenon strobe light and a standard flashlight, with built-in filters of various colors, was developed. Evaluation of the light was in progress at the time of deactivation.

TASK NUMBER: 02-E-74

TITLE: Paratroop Assembly Device

AUTHORIZED FUNDING: \$17,000

TASK DURATION: 13 August 1973

DESCRIPTION AND RESULTS: This effort, still open upon deactivation, involves an in-house study to investigate the techniques and capabilities of low frequency radio direction finding as they relate to the problem of providing a paratroop assembly device. The assembly location will be "marked" with a transmitter and each jumper will be provided with a small, lightweight, very low cost, hand-held receiving device which indicates the general direction to the assembly point. Low frequency radio direction finding techniques and antenna designs will be studied leading to a suitable design for guiding walking ground personnel through foliage and over hills to an assembly area. The device can also be used on cargo and equipment so that individuals can locate special cargo bundles and crews can find crew served weapons.

The system should have the capability of propagating its signals to a range of 2 kilometers through vegetation and around small hills. These signals must not be detectable by the unaided human senses. The receiving devices shall be small and cheap, with a mission life time of about 45 minutes. The assembly point transmitter will provide continuous operation, an omnidirectional radiation pattern over a range of 2 kilometers, and a mission life time of 1 hour. All units must be rugged enough to survive parajump operation and must function reliably under paradrop weather conditions.

TASK NUMBER: 03-E-74

TITLE: Improved Integrated Communication/Protective Helmet Systems

AUTHORIZED FUNDING: \$7,500

TASK DURATION: 29 August 1973

DESCRIPTION AND RESULTS: A communication system was integrated with a safety-certified motorbike helmet. Two units were built that incorporate a newly developed and improved noise and vibration suppression microphone in addition to a conventional earphone listening device. The system connects to the PRC-77 radio set with quick-disconnect cables which are configured so as not to interfere with the motorbike operator in any way.

A MIPR to develop two integrated communication/protective helmet systems at a cost of less than \$2000 under a FY 73 GNI was sent to Naval Air Development Center. The units were installed in crash-safety approved helmets for MASSTER evaluation, which was in progress at the time of deactivation.

TASK NUMBER: 04-E-74

TITLE: Artillery Launched TV (OCRD)

AUTHORIZED FUNDING: \$55,000

TASK DURATION: 7 September 1973

CONTRACTOR: Fairchild Space & Defense Systems

DESCRIPTION AND RESULTS: This task was developed to perform a design study of an artillery launched, parachute-carried, aerial TV reconnaissance system and assemble demonstration hardware using existing equipment. The study was to determine the capabilities, limitations and cost of an expendable round, reusable base-station system. The demonstration hardware was to simulate a parachute system by using a 100 element by 100 element CCD TV camera attached to a helicopter equipped with an existing commercial TV transmitter.

The program was coordinated with the Naval Weapons Lab who has a similar interest. Work was still in progress upon deactivation.

B-73

TASK NUMBER: 01-F-63

TITLE: Grenade Dispenser

AUTHORIZED FUNDING: \$34,459

TASK DURATION: 29 November 1962 to 23 January 1964

DESCRIPTION AND RESULTS: Design and develop means for the releasing of hand grenades from helicopters using M26 grenades with specified fuzes. Remote operation, maximum personnel and aircraft safety are required. The prime purpose of this device is to discourage and suppress ground fire.

Developed by the Technical Support Division, Limited War Laboratory, the item was delivered to Vietnam for field testing and evaluation in April 1963.

TASK NUMBER: 02-F-63

TITLE: Squeezebore

DESCRIPTION AND RESULTS: Investigate the desirability of utilizing the .50 caliber machine gun in jungle by increasing the density and dispersion of firepower. Salvo squeezebore ammunition which was developed by The RICA Company, Costa Mesa, California, enables the firing of five fully stabilized bullets of rifle bullet scale and velocity through a dispersion cone of approximately seven mils with each caliber .50 round fired. This additional firepower is achieved by placing five bullets in series and replacing the weapon barrel with a tapered one which squeezes the bullets from .50 to .30 caliber.

The RICA Company demonstrated the .50/.30 Salvo Squeezebore Machine Gun System at Aberdeen Proving Ground in August 1962.

In December 1962, a contract under Advanced Research Projects Agency funding, was awarded to The RICA Company to fabricate 11,000 rounds of squeezebore ammunition (caliber .50 to caliber .30, each round of caliber .50 containing five projectiles) and six modified M2 caliber .50 machine gun barrels.

Analysis of the test data showed that the design of the subject system was not suitable for service use, although it possessed some merit.

TASK NUMBER: 03-F-63

TITLE: Counterambush Weapon

AUTHORIZED FUNDING: \$50,692

TASK DURATION: 11 December 1962 to 29 December 1964

CONTRACTOR: Remington Arms Company

DESCRIPTION AND RESULTS: Development and fabrication of a multiple shot gun counterambush weapon to be mounted on a vehicle and be effective over an area described as a sector of a circle having a radius of 50 meters and an inclosed angle of 150 degrees.

A counterambush weapon model, CAW I, was fabricated under contract by the Remington Arms Company. The weapon consists of 48 shortened 12 gauge shot gun barrels mounted at various angles in banks of 3 or 6. The efficacy of the system was demonstrated by Development and Proof Services of APG, by firing all guns in 6, 30 and 60 second intervals against curved vertical targets placed at 10, 25 and 40 meters range. Evaluation and analysis of these data when compared to similar data obtained with the Claymorette (CAW II) system (Task 05-F-63) indicated the CAW I required excessive field maintenance and provided a less effective dispersion pattern.

TASK NUMBER: 04-F-63

TITLE: Timing Device for Fuzes

AUTHORIZED FUNDING: \$12,311

TASK DURATION: 11 December 1962 to 17 August 1964

DESCRIPTION AND RESULTS: Develop an electroplate cell with appropriate circuitry to automatically deactivate or activate explosives such as mines at a pre-set time. This device is a small unit less than 2 cubic inches in volume in solid block form. It is non-magnetic and has no moving parts. Effective time can be varied from hours to months.

Twelve Bissett-Berman Corporation electro-plate cell timing devices were purchased for evaluation. The timers were tested for the accuracy of their 8 hour - 16 hour cycle and their reliability of functioning over 10 day and 20 day periods. Of the 12 devices tested only 2 were accurate to the desired 1% for 10 or more days. Lacking the necessary accuracy and reliability for use in village defenses, no further work was done on this task.

TASK NUMBER: 05-F-63

TITLE: Counterambush Weapon II (M18A1)

AUTHORIZED FUNDING: \$188,341

TASK DURATION: 15 January 1963 to 28 January 1966

DESCRIPTION AND RESULTS: Design, develop and fabricate a counterambush weapon to be mounted on a vehicle and be effective over an area described as a sector of a circle having a radius of 50 meters and an inclosed angle of 150 degrees.

Two counterambush weapons systems based on the M18A1 Anti-Personnel Mine or its principle were developed. One system consists of a standard M18A1 Mine mounted on the bumpers of a 2½ ton truck. The other system has a series of miniature M18A1 type mines (Claymorette - CAWII) fastened to a board mounted on the side of the 2½ ton truck. Each system is fired electrically from a console that can be mounted in either the cab or the body of the vehicle.

Engineering design tests were completed on the second system and a Safety Release for limited use was obtained. The release requires personnel in the truck cab to wear ear protection or to cover their ears when firing the system.

The Advanced Research Projects Agency (ARPA) requested LWL to procure 2400 munitions and five truck systems for field evaluation in Vietnam.

TASK NUMBER: 06-F-63

TITLE: Improved Sighting System for Small Arms

AUTHORIZED FUNDING: \$38,709

TASK DURATION: 12 March 1963 to 2 October 1964

CONTRACTOR: General Precision

DESCRIPTION AND RESULTS: Develop a sighting system for rifles and other small arms weapons that may be used by Special Forces personnel in their unconventional warfare role of training indigenous personnel who have had extremely limited experience with modern weapons. This device is expected to reduce the time required to train these personnel and also increase the sighting accuracy of the trainee. The sighting system under investigation utilizes an image correlation technique and is mounted at the usual location of the rear sight, thereby eliminating the need for a front sight. This system is free of parallax and permits transverse movement of the user's eye without loss of sighting accuracy.

Engineering design and informal military potential tests indicated that the correlator gunsight has useful application as a training sight and some potential as a battlesight. The primary problem encountered with this particular sight was that the amount of light received through the device was limited plus the device was not considered rugged enough for field use.

TASK NUMBER: 07-F-63

TITLE: Aerial Smoke Marker and Dispenser

AUTHORIZED FUNDING: \$195,447

TASK DURATION: 12 March 1963 to 4 May 1966

DESCRIPTION AND RESULTS: The purpose of this task was to design, develop and fabricate a floatable, five-minute white smoke marker munition which could be hand-thrown or launched by dispenser from fixed-wing aircraft or helicopters at speeds not greater than 250 MPH. The munition to be releasable on any type terrain without degradation of its performance.

The system developed consists of a special smoke marker munition and a six-tube dispenser. The munition is 3-3/4 inches in diameter, 24-1/2 inches long, weighs 7-1/4 pounds and contains three AN-M8 white smoke grenades which burn sequentially, providing a 5- to 6-minute burning time. The dispenser, which weighs 45 pounds, was redesigned so that release of the munitions can be controlled by the "Bomb Release" switch of the aircraft. All available information and drawings on this system were furnished to AMC for use in the procurement of 2,000 white smoke marker munitions in response to a Quick Reaction Letter. Two six-tube dispensers and associated cabling along with 300 munitions were shipped to Vietnam in November 1965 for evaluation.

A request was received from Chief, JRATA, Vietnam to incorporate a two-second delay for release of the parachute after the fuze handle was released. A modification was made to the internal configuration of the Smoke Marker to include this desired delay. An M201A1 hand grenade fuze was used in place of the fuze previously used. A Safety Release for this new arrangement was issued by USATECOM in April 1966. Two hundred smoke marker munitions with the new fuze were fabricated for evaluation.

TASK NUMBER: 08-F-63

TITLE: Propaganda Leaflet Bundle Breaker

AUTHORIZED FUNDING: \$271,389

TASK DURATION: 7 May 1963 to 29 March 1968

CONTRACTORS: Sanders Associates, Inc.; Kollsman Instrument

DESCRIPTION AND RESULTS: Design and develop leaflet bundle opening devices to permit the release of propaganda leaflets from Army aircraft flying at altitudes between 500 and 8,000 feet. The opening altitudes of the leaflet bundle will be about 300 feet above terrain. The bundle breaker device will be designed for use with leaflet packages containing 1,000 to 10,000 leaflets in increments of 1,000.

The Leaflet Bundle Breaker developed is a settable barometric device. The functioning altitude of the Bundle Breaker can be set in 100-foot increments to any altitude from 300 to 8,000 feet above sea level.

After delivering 50 acceptable pilot lot models which met SDR accuracy and reliability requirements, the contractor assembled and delivered 347 units for Engineering Design Tests and user evaluation. Seventy of the production units were conditioned at 70°, 95°, 155° and -65°F with exposure to rain, sand, dust and frost. These units were set to function at 500 and 1,000 feet and were dispensed from aircraft at 4,000 and 8,000 feet. Only 40% of the units operated within 300 feet of the set altitude. Fifteen per cent were 600 feet off, 10% were duds and the balance functioned prematurely during descent. Only 15 of the 70 units functioned within the originally prescribed 150 feet of set opening altitude. The SDR was deleted from CDOG on 31 Oct 67 and the USALWL project terminated as directed. Forty-seven Bundle Breakers were shipped to 8th Special Forces Group in Panama for their evaluation. Test data, instruction manuals and 200 packaged Bundle Breakers are available to any interested agency.

TASK NUMBER: 01-F-64

TITLE: Lightweight Truck Armor

AUTHORIZED FUNDING: \$31,329

TASK DURATION: 29 August 1963 to 17 March 1965

DESCRIPTION AND RESULTS: Study and test materials indigenous to tropical areas, such as South East Asia, for their bullet stopping capabilities. Successful materials would then be considered for use as lightweight truck armor to protect personnel riding in the cab and truck body from enemy small arms fire.

Numerous materials and combinations of materials were tested by the Development and Proof Services, Aberdeen Proving Ground, Maryland. Various combinations of clay tile bonded to a wood backing were found to be more effective than an equal weight of rolled homogeneous steel armor.

A specific combination of one-inch thick Vietnamese clay tile backed by 5 inches of Bombax wood was found to provide approximately 7% better overall protection than an equal weight of steel. Although the armor will provide protection against Cal. 0.30 ball ammunition fired at standard muzzle velocity, the effectiveness of the protective material is destroyed in the immediate area of projectile impact. The protection capability of the remaining portion of the armor is not degraded.

LWL Technical Note 4 and Addendum 1, thereto, were issued to disseminate technical data acquired during the D&PS testing. A manual on "The Use of Field Expedient Armor" was also sent to Vietnam for issue.

TASK NUMBER: 02-F-64

TITLE: Tunnel Detection Munitions

AUTHORIZED FUNDING: \$12,428

TASK DURATION: 14 August 1963 to 9 November 1964

CONTRACTOR: Miller Research

DESCRIPTION AND RESULTS: To investigate the feasibility of utilizing explosive devices to provide a positive indication that a tunnel exists, and through the use of this device create an entrance hole into the tunnel from above ground.

Feasibility tests of shaped charges and an explosive pile driving system were conducted. Although the pile driving technique provides a possible solution to the problem, it was desirable logistically because of the numerous components. In tests at Aberdeen Proving Ground, a commercial shaped charge with 2 ounces of explosive provided a 2-1/2 inch borehole 2-1/2 feet deep; the 3.5 inch warhead of the M28A2 HE, AT Rocket with 1.9 pound of explosive provided a 5 inch borehole 4 feet deep; and the M2A3 shaped charge with 11.5 pounds of explosive provided a 12 inch borehole 8-1/2 feet deep. The results indicated that items in the inventory were satisfactory for this task.

TASK NUMBER: 03-F-64

TITLE: Battlefield Illumination

AUTHORIZED FUNDING: \$889,158

TASK DURATION: 20 September 1963 to 17 December 1968

CONTRACTORS: Northrop Carolina; Amcel Propulsion Company

DESCRIPTION AND RESULTS: Determine the feasibility of designing and developing an illumination system capable of providing a minimum of five minutes illumination (0.05 foot candles) over a clear circle 400 meters in diameter. A Battlefield Illumination System was developed weighing approximately 13-1/2 pounds and wholly contained in a 5-inch x 6-inch x 21-inch long molded plastic case. The system contains 12 individual projectiles which contain a parachute deployed illuminating candle. Each projectile is propelled sequentially to a horizontal range of approximately 600 meters and deployed at an elevation of approximately 600 feet. Each deployed candle will provide illumination in a 400 meter diameter area on the ground for a period of approximately 40 seconds. The total illumination period for the system is approximately 6 minutes. The system also has an interrupt capability which will provide illumination periods of one minute, three minutes, and five minutes of time.

The DA approved SDR requires that sufficient illumination be provided so that friendly troops will have a 70% probability of detecting and locating a target with sufficient accuracy to bring small arms fire to bear under the following conditions:

- a. Target is stationary, standing man.
- b. Ground distance from directly below the light source to small arms fire is 200 meters.

Engineering Design and Safety Release Tests were completed and a Safety Release was issued for the system. Fifty-two systems were shipped to Vietnam in Dec 66 for field evaluation. Additional systems were manufactured for Reliability Testing.

TASK NUMBER: 04-F-64

TITLE: Smoke Screen, Troop Landing

AUTHORIZED FUNDING: \$134,907

TASK DURATION: 7 November 1963 to 11 August 1965

CONTRACTOR: Maxson Electronics

DESCRIPTION AND RESULTS: Design, develop and fabricate a device for use with the UH-1B helicopter to demonstrate the feasibility of producing a smoke screen approximately 1,000 meters long for protection of troops disembarking from the helicopter. The LWL system consists of two XM-3 2.75 inch Rocket Launchers, mounted one on each side of a UH-1B helicopter and each fitted with an easily mounted adapter to permit release of a total of 288 standard AN-M8 Smoke Grenades. The XM-3's are mounted on the helicopter in reverse direction so that the grenades are ejected rearward during flight. In order to insure proper functioning of the grenade, a small parachute has been attached to retard its rate of fall. With the UH-1B flying at an altitude between 200 and 300 feet and at a speed of 50 to 90 knots, the system will provide a smoke screen along a line approximately 1,000 meters long.

Four troop landing smoke screen adaption kits requested by U. S. Army Support Command, Vietnam, in June 1964, were fabricated and shipped to Vietnam in October 1964. The system demonstration was so successful that Army Support Command requested six additional kits for Airmobile Companies in Vietnam. These were procured by MICOM and shipped to Vietnam in February 1965.

TASK NUMBER: 06-F-64

TITLE: 60MM Mortar

AUTHORIZED FUNDING: \$44,932

TASK DURATION: 23 December 1963 to 2 February 1965

DESCRIPTION AND RESULTS: Test and evaluate the T93 Lightweight Mortar developed by Watervliet Arsenal and modified to USALWL specifications. This weapon fires standard 60mm ammunition from a 15-inch launching tube which is hand-held on a high-strength aluminum base. The overall system weighs about 6 pounds and represents a 14-pound weight saving over the hand-held M18 60mm Mortar.

Six mortars, fabricated by Watervliet Arsenal, were tested at APG during the second quarter, FY65. Results of the firing trials indicated that hand-directed fire can be efficiently delivered from the mortar with relative ease and without special training. Safety release was recommended with certain limitations on size of the propelling charge.

TASK NUMBER: 07-F-64

TITLE: Shotshell Adaptor for M79 Launcher

AUTHORIZED FUNDING: \$22,582

TASK DURATION: 7 December 1964 to 2 February 1965

CONTRACTOR: Olin Mathieson Chemical Corporation

DESCRIPTION AND RESULTS: Provide an adapter for the M79 Grenade Launcher which would permit standard shotgun ammunition to be used to provide a close-in kill capability for this weapon. Standard 40MM ammunition for this weapon kit has a minimum safe arming distance of 60 to 90 feet. This work was requested by the Special Warfare Division of OCRD. The design, development and fabrication of the LWL Shotshell Adapters were performed under contract. The adapter weighs approximately 8 ounces and consists of a 6 inch steel tube with a 12 gauge chamber and an outer plastic sleeve.

Tests were conducted at APG to determine the effect of 4 different chokes on shot patterns at 10, 25 and 40 meters range. The tests showed that the pattern with an improved cylinder choke was not significantly different from the full-choke pattern. Twenty adapters with improved cylinder chokes were procured for field evaluation. These adapters were safety-certified by the USATECOM for use with 2-3/4 inch 12 gauge ammunition containing 27 pellets of No. 4 buckshot. Five adapters were shipped to S. E. Asia for field evaluation.

TASK NUMBER: 01-F-65

TITLE: Compact Rifle Sight

AUTHORIZED FUNDING: \$63,214

TASK DURATION: 3 August 1964 to 15 February 1967

DESCRIPTION AND RESULTS: Develop a small rifle sight that will improve the shooting effectiveness of the average soldier, especially against short-range, short-exposure-time targets. Additionally, this sighting system would simplify and expedite rifle marksmanship training.

This task is a follow-on to an investigation of a correlator gunsight (Improved Sighting System for Small Arms, Task 06-F-63) that would aid Special Forces personnel in the training of indigenous paramilitary personnel. Because of deficiencies evident in the sight, especially light loss and optical cluttering of the target picture, the reflex-collimator technique was selected for further investigation.

A small reflex-collimator sight was designed and a feasibility model was fabricated and evaluated. Based upon this evaluation, a sight and mount were designed for the M1 and M14 Rifles. The sight is less than three inches long, mounts in place of the standard rear sight, and can be made rugged and weatherproof. It provides the user with considerable freedom in horizontal, and vertical eye position without discernible parallax. Two sights and two mounts were built and Engineering Design Tests were conducted. Subsequently, the mount was redesigned to improve control of the windage adjustment. Twenty sights and twenty mounts were fabricated for special tests including Military Potential Tests. During the Engineering Design Tests, very accurate shot patterns at ranges from 50 to 400 meters were achieved.

TASK NUMBER: 02-F-65

TITLE: Aircraft Smoke Marker (Colored)

AUTHORIZED FUNDING: \$59,487

TASK DURATION: 1 July 1964 to 22 April 1966

DESCRIPTION AND RESULTS: The purpose of this task was to develop a three-minute colored smoke marker for use for various fixed-and-rotary-wing aircraft. It would provide aircraft observers with a capability to mark targets, drop zones, landing zones and medical pick-up sites. The munition would be capable of being hand-ejected or automatically dispensed from aircraft of the O-1, and UH-1B types. This task conformed to an SDR for a Smoke Marking Munition and Aerial Dispenser which required red, green and yellow smoke markers that are compatible with the white smoke munition and aerial dispenser developed under another project.

A test of 50 SMM was conducted in November 1965. The introduction of new colored smoke grenades (w/o holes in top lid) did not affect ignition transfer design changes since the contractor perforated each grenade during assembly. However, ignition problems necessitated modification and testing of another 45 units before a fix was reached and 205 acceptable SMM's could be built. The quickmatch formerly used to assure ignition transfer from the M700 delay fuze to subsequent grenades, has been replaced, due to its handling sensitivity, by a cup of ignition mixture crimped to the M700 fuze.

Twenty-four each red, yellow, green and violet E-29 Smoke Markers were shipped to Vietnam in March 1966. Five hundred each red, green and yellow Smoke Markers were procured by AMC to meet the request made by a Quick Reaction Letter. All available information and drawings were furnished to AMC for use in the type classification of this munition.

TASK NUMBER: 03-F-65

TITLE: Special Sight Mount

AUTHORIZED FUNDING: \$10,807

TASK DURATION: 30 September 1964 to 27 October 1965

DESCRIPTION AND RESULTS: Provide brackets to mount the T1 Infrared Sight on the standard M1 Rifle, the M1 Carbine, the M16 Rifle and the M1919A4 Machine Gun. Brackets were designed and fabricated at LWL to mount the T1 Infrared Sight on the four weapons mentioned above. The bracket design for the M1 Rifle and the M1 Carbine requires that the rear sights be removed to assemble the brackets. The brackets are mounted on the M16 Rifle and the M1919A4 Machine Gun without any modification to the weapons. Firing tests were conducted by the Small Arms Branch of D&PS, Aberdeen Proving Ground, Maryland, to determine if the sight bracket designs could withstand repeated firings and remain securely on the weapons. These tests were successful.

Additional brackets for each weapon were fabricated under contract. Twenty brackets for each of the three rifles (the M-1 Rifle, the M-1 Carbine, and the M-16 Rifle) and ten for the M1919A4 Machine Gun were fabricated and shipped to Vietnam. Instruction manuals for assembly were prepared by LWL and shipped with the brackets.

TASK NUMBER: 04-F-65

TITLE: Smoke Screen Adaptor for LAU 3/A

AUTHORIZED FUNDING: \$78,914

TASK DURATION: 21 October 1964 to 30 January 1967

DESCRIPTION AND RESULTS: Develop an adapter plate and intervalometer kit that will permit the LAU-3/A 2.75-inch Rocket Launcher to be used to lay a smoke screen. The system will operate in the same manner as the Troop Landing Smoke Screen System on the XM-3 Rocket Launcher (see LWL Task 04-F-64).

An adapter kit was developed consisting of two aluminum plates which clamp onto the discharge end of the nineteen-tube LAU-3/A rocket pods. Since the grenades are launched rearward, the pod is flown reversed on the equipment mounting shackles of the aircraft. Ejection power is provided by a coiled constant-force spring. When loaded, each tube is closed off by a stamped metal door. The system is activated by releasing the door, using a remotely controlled solenoid to actuate a mechanical latch. Sequencing of the solenoids is controlled by an intervalometer in the aircraft cabin. The rate at which the tubes are discharged can be varied on the intervalometer to compensate for varying aircraft speeds.

Since the LAU 32 Launcher operates in the same manner as the LAU-3/A and contains seven tubes, a prototype model was fabricated and successfully tested on this launcher. After these tests were completed, three LAU-3/A Adapter Kits and intervalometer system were fabricated for testing and evaluation. Engineering design tests were conducted on both the LAU-3/A and LAU-32 adapter systems. A Safety Release for limited use was obtained in April 1966. An Installation and Operation Manual was prepared for both the LAU-3/A and LAU-32 Adapter Systems.

TASK NUMBER: 05-F-65

TITLE: Floating Smoke Grenade

AUTHORIZED FUNDING: \$53,672

TASK DURATION: 21 October 1964 to 20 January 1967

DESCRIPTION AND RESULTS: Develop a Grenade Floatation Attachment (GFA) to enable the AN-M-8 or other smoke grenade to float and continue effective smoke emission after water impact. This attachment shall permit position-marking and smoke screen-laying over swamps, rivers, canals and other watery areas where smoke grenades would be snuffed out upon immersion. For maximum utility the attachment should not prevent grenade launching from the XM-3, LAU-3/A or LAU-32 Rocket Launchers.

In the LWL developed device, a slip-on shroud (can) with a holding ring is slipped over the grenade after removing the fuze. The fuze is reinserted into a fuze holder in the top of the can which prevents premature extension of the can into the floating position. In normal use - after handle release, whether manually or from 2.75" launcher - the heat and smoke build-up melt the plastic fuzeholder and extend the can. It will then float, after impact, until the grenade has burned out. In addition, after about 30 seconds burning time, the plastic fuze holder will soften and allow the fuze to pop off. This permits freer smoke flow and reduces the tendency of the grenade to tip over.

It was determined in limited tests at LWL and by the Navy SEAL Team Two that the AN-M8 Smoke Grenade with GFA will function reliably when hand dispensed from shore or boat into shallow or deep water. When these units are dispensed from aircraft over 100 feet high or from a grenade dispenser in a boat, the system lacks reliability. If the GFA is to be carried and used underwater, it must be protected by a plastic bag to prevent the pyrotechnic mix in the smoke grenade from getting wet. Sixteen hundred and twenty (1,620) GFA's were shipped to Vietnam for evaluation in Nov 66.

TASK NUMBER: 06-F-65

TITLE: Grenade Launcher for M1 Rifle/Carbine

AUTHORIZED FUNDING: \$12,225

TASK DURATION: 7 May 1965 to 15 August 1966

CONTRACTOR: Colts Inc.

DESCRIPTION AND RESULTS: Develop a bracket to adapt the 40mm Grenade Launcher, CGL-4, to the M1 Rifle and the M1 and/or M2 Carbine and furnish three prototypes of each bracket with launcher to JRATA for evaluation in Vietnam. The XM-148 Launcher was mounted on the barrel of the M-1 Carbine. The carbine forearm was cut back and a bushing placed around the carbine barrel to allow the launcher recoil forces to be transmitted to the portion of the stock which was designed to withstand recoil. The XM-148 Launcher was mounted on the M-1 Rifle through the front hand guard to the barrel and also the bayonet lug. An extension bar was attached to the right hand side of the parent weapon to bring the Launcher trigger near the trigger of the parent weapon.

Three of these launchers were mounted on the M-1 Rifle and three on the M-1 Carbine. The rifle mounted launcher was too cumbersome and unwieldy and this phase of the project was terminated. The Carbine mounted launcher was tested for handling and safety through USATECOM and released for evaluation by OCONUS. Installation, Operation and Maintenance Manuals were prepared for use with this adaptation. Three XM-148 Launchers, modified carbine stocks, mounting hardware and manuals were shipped to JRATA for evaluation in December 1965.

TASK NUMBER: 07-F-65

TITLE: Telescope and Mount/M14 Rifle

AUTHORIZED FUNDING: \$2,651

TASK DURATION: 23 June 1965 to 18 October 1965

DESCRIPTION AND RESULTS: Design and develop a prototype telescope and mount assembly to provide sniper capability for the M-14, Cal. 7.64mm Rifle. A standard commercial rifle telescope, Bushnell Scope Chief II 3x - 9x Variable w/cross hairs and command post reticle, was procured. A mount base, for use with a commercial telescope mount, was designed and fabricated in-house for the M-14 Rifle. A Colt Realist 3x telescope, with integral mount, was procured for the M-16 Rifle. A cheek pad assembly, standard for the M-1C, Caliber .30 Rifle (Snipers), was modified for use with the M-14 Rifle. Commercial rain and sun neoprene shields were procured for both telescopes.

After handling and firing tests were conducted, the two telescopes with mounts, cheek pad assembly, rain and sun shields and mounting instructions were shipped to Vietnam to 1st Cavalry Division (Air Mobile) in October 1965 for evaluation. After return of the items from 1st Cavalry, the same systems were shipped to Vietnam for the 1st Infantry Division for evaluation.

TASK NUMBER: 08-F-65

TITLE: Smoke Marker Dispenser SMD-1

AUTHORIZED FUNDING: \$17,000

TASK DURATION: 24 June 1965 to 28 December 1965

DESCRIPTION AND RESULTS: The Smoke Marker Dispenser SMD-1 system development was undertaken as the result of a field request for a dispenser for LWL Aerial Smoke Marker (Refer to LWL Tasks 07-F-63 and 02-F-65) which did not require the use of the bomb shackles. It was intended to provide a method for electrical or mechanical aerial release of the Smoke Marker.

The Smoke Marker Dispenser System, developed by LWL, is a four-tube system consisting of two tubes mounted on each side of the aircraft. It may be mounted, in the field, on the O-1 or HU-1 aircraft without utilizing or interfering with any of the stores- or armament-mounted provisions. One 7-1/2 pound Aerial Smoke Marker is carried in each tube and can be released in flight either electrically or manually. The total weight of the system is approximately forty-six pounds empty. Loaded, the system weighs seventy-six pounds. An aircraft vibration test and a test to determine the effect of a smoke marker burning in the tube were conducted. The dispenser was considered safe for use on both the O-1 and HU-1 aircraft and a safety release was issued.

TASK NUMBER: 01-F-66

TITLE: Position Marker

AUTHORIZED FUNDING: \$157,433

TASK DURATION: 24 January 1966 to 24 April 1967

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: Two separate approaches were taken to provide a smoke signal for indicating to overflying aircraft the location of troops in areas having a jungle canopy. The initial approach was to modify the M127A Hand-Held Signal. The other approach was to provide a 40MM Position Marker which could be fired from the M79 Grenade Launcher.

Engineering Design and Safety Release tests for the Hand-Held Position Marker (PM-1) were completed during Nov 66. A limited procurement of 504 position markers was made in Dec 66 for field evaluation in Vietnam. These position markers were shipped during Jan 67 for this operational evaluation and a final report entitled "Feasibility and Development of a Hand-Held Position Marker" was written and distributed. The feasibility and development of this project was successfully demonstrated.

Feasibility and development of the 40MM Position Marker (PM-2) was completed during Sep 66 and Report No. LWL-CR-01-F-66 entitled "Feasibility and Development of a Position Marker" was published. Engineer Design and Safety Release testing was completed and a Safety Release issued during Feb 67 under USATECOM Project No. 8-6-2310-04. Since the M79 Grenade Launcher was phased out, the 40MM Position Marker (PM-2) program was terminated, after completion of the final report and engineer and safety release testing, because this round will not fit the XM148 Grenade Launcher. Position Marker (PM-3) has been established to develop a 40MM Position Marker which will fit the XM148 Grenade Launcher.

TASK NUMBER: 02-F-66

TITLE: Counterambush Weapons System (Study)

AUTHORIZED FUNDING: \$3,581

TASK DURATION: 17 October 1965 to 9 December 1965

DESCRIPTION AND RESULTS: A representative ambush situation was detailed; system goals were defined and evaluation models for determining the merit of competing systems were developed. Based on the resulting information, a number of diverse techniques and systems were studied and subsequently culled on the basis of tactical considerations, state-of-the-art, and the ability to perform the required mission. Those systems which showed promise were then analyzed more rigorously and compared quantitatively in their ability to perform the required mission, and to satisfy the requirements stated in the SDR. The results of this study were used to establish a task for Counter Ambush Weapon System (CABWS) (04-F-66).

A report entitled "Convoy Counterambush Weapon Systems" was completed and published as LWL TR-66-01. In addition, the information was presented at an IPR for Counterambush Barrage Weapons held at the LWL on 16 December 1965.

TASK NUMBER: 03-F-66

TITLE: Small Arms Protection for Vehicles

AUTHORIZED FUNDING: \$312,344

TASK DURATION: 3 December 1965 to 11 October 1967

DESCRIPTION AND RESULTS: The USALWL was directed to fabricate 20 lightweight armor kits each for the 1/4 ton, 3/4 ton, 2-1/2 ton and 5 ton trucks and two types of river junks; Yabuta and Command. These kits were to provide limited protection from a small arms ambush assault up to caliber .30 ball. The kit designs provide wrap-around protection specifically for each of the vehicles listed with many interchangeable components among the various vehicles. The kits are made of 1/4" high hard steel and 2-1/4" safety glass laminate for bullet protection from point-blank range and 100,000 psi yield strength steel for the explosive deflecting skid plate under the cab of each vehicle. The Development and Proof Service design criteria indicate a protection level up to one pound HE.

Twenty armor kits for the 1/4 ton M151 truck and 20 armor kits for the 2-1/2 ton M211 truck were fabricated and shipped to Vietnam in Aug 66. Twenty armor kits for the 3/4 ton M37 truck and twenty armor kits for the 5 ton M54 truck were fabricated and shipped to Vietnam in Feb and Mar 67. Twenty armor kits for the Yabuta III Junk and 20 armor kits for the Command Junk were fabricated and shipped on 8 Sep 67 to the Vietnamese Naval Supply Center. The designated parent agency for this task was the U. S. Army Tank - Automotive Command. They processed Limited Production Type Classification for the 1/4 ton kit and manufacturing kits for 1/4 ton and 5 ton trucks in response to ENSURE No. 7.

TASK NUMBER: 04-F-66

TITLE: Counterambush Barrage Weapons System

AUTHORIZED FUNDING: \$1,229,568

TASK DURATION: 23 November 1965 to 10 May 1971

CONTRACTORS: Miller Research Corporation; FMC Corporation

DESCRIPTION AND RESULTS: The Counter Ambush Barrage Weapon System XM55 (CABWS) is a modular armament system designed to provide an immediate counterbarrage on an area basis against enemy personnel ambushing logistic vehicles, thereby offsetting the initial element of surprise and mass of fire that normally are experienced in ambushes and allowing personnel time to disembark and launch a counterattack. Each barrel of a 306-barrel module (Caliber .22 Multiple Barrel Gun XM215), is loaded with a Caliber .22 Long Rifle Cartridge M24 and the barrels are oriented at 1° increments of spread, thereby providing a 15° x 20° pyramidal cone of fire. The cartridges are initiated electrically and firing is randomly distributed throughout the module at a rate determined by the firing circuit. The total number of modules mounted on the periphery of a vehicle depends on the desired area of coverage, firing time, and density of fire.

After the feasibility of electrical initiation of percussive rim-fire cartridges was demonstrated, Engineering Design and Safety Evaluation Tests were conducted on two prototype systems. A number of improvements were subsequently incorporated into one of the prototype systems and four new systems were fabricated for use in Engineering and Service Tests. Systems for ET/ST were delivered to the Materiel Test Directorate of Aberdeen Proving Ground, the U.S. Army Infantry Board, and the U.S. Army Tropic Test Center during FY70. MTD determined that the CABWS was safe for service testing and engineering testing was underway when all testing was suspended at the request of USACDC. The requirement was reevaluated after which it was cancelled during 1st Qtr FY71. Frankford Arsenal, the designated parent agency, completed the Technical Drawing Package and the Draft Equipment Publication (Operator, Organizational, Direct Support, and General Support Maintenance Manual for Counter Ambush Barrage Weapon System XM55, Draft TM 9-1095-254-14). In 3d Qtr FY71, four systems were packaged for shipment to RVN in response to a field request; however, the request was withdrawn.

TASK NUMBER: 05-F-66

TITLE: Adjustable Ranging Telescope (ART)

AUTHORIZED FUNDING: \$22,420

TASK DURATION: 27 December 1965 to 31 August 1967

DESCRIPTION AND RESULTS: The Adjustable Ranging Telescope System consists of four main components:

- a. Telescope, Variable, 3x to 9x, w/stadia lines on reticle.
- b. Ballistic cam attached to the variable power actuating ring of the telescope.
- c. Mount, detachable.
- d. Mount base.

In operation, once the weapon has been "zeroed" at a given range, the power actuating ring is adjusted so the stadia lines span 30 inches on a target of opportunity. The ballistic cam, which is connected to the power actuating ring, changes the angle of departure of the scope/weapon such that the "zero" of the system is adjusted to the target range. In practice, this means that a weapon, such as the M14, Caliber 7.62mm Rifle, has a much improved first round hit capability from 300 meters to 900 meters.

An evaluation by ACTIV resulted in an ENSURE Request for 65 Adjustable Ranging Telescopes. The telescopes, the required mounting brackets and carrying cases were shipped in October 1968. Liaison was initiated with the designated Parent Agency, USAWECOM, so that normal supply methods could be used for future procurements.

TASK NUMBER: 06-F-66

TITLE: 40MM Multishot Cartridge

AUTHORIZED FUNDING: \$17,391

TASK DURATION: 27 December 1965 to 3 January 1967

DESCRIPTION AND RESULTS: This cartridge was designed for use in the 40MM M79 Grenade Launcher to provide the grenadier with an effective multi-projectile capability for unaimed snapshooting (pointing) at close ranges. The 40MM Multishot Cartridge is similar to the standard 40MM Grenade in overall size, shape, and weight except that the nose is blunt rather than having the conventional ogive. It is easily distinguished from the standard grenade and yet can be carried in the standard 40mm ammunition bandoleer. The body of the round contains 18 subcaliber chambers with smooth-bore barrels.

A feasibility study was completed. Fifty reloadable aluminum cartridges were procured and feasibility tests were conducted. The test performance was excellent and the test results were forwarded to the USAMC Project Manager for Selected Ammunition. USALWL was phased out of this program and Frankford Arsenal conducted advanced development.

TASK NUMBER: 07-F-66

TITLE: Magazine, Disposable Plastic 5.56MM and Bandoleer

AUTHORIZED FUNDING: \$117,541

TASK DURATION: 11 March 1966 to 24 November 1969

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The Plastic Magazine has the same general shape, size, and capacity as the standard aluminum magazine used with the M16 Rifle. It is intended as a truly disposable magazine or a low-cost replacement for the standard magazine. The substitution of plastic for metal provides the following advantages: (1) Reduces rattling while being carried on patrols, (2) less likely to corrode in jungle atmosphere, (3) denies the enemy useable material, and (4) reduces production cost. The magazine can be reloaded with standard stripper clips, and the base can be easily removed for cleaning.

Results of the Engineering Design Tests indicated that the increased demands on the magazine material and design, through increased scope of the task, nearly exceeded the practical and physical limits of that material. The test results showed that this magazine did not perform as well as the standard metal magazine under all environmental test conditions. The U.S. Army Weapons Command, the designated parent agency for this task, received preliminary technical data and conducted future work.

TASK NUMBER: 08-F-66

TITLE: Mag Teflon Counterambush Weapon (MTCAW)

AUTHORIZED FUNDING: \$209,737

TASK DURATION: 14 March 1966 to 24 July 1968

DESCRIPTION AND RESULTS: The purpose of this task was to determine a suitable method of employing Magnesium Teflon (Mag Teflon) in conjunction with a vehicle mounted counter ambush kinetic energy weapon in order to enhance its output and effectiveness.

Mag Teflon pellets, ignited inside the gun barrel, were fired from a gun tube. The initial combination, although primitive in terms of a developed round, demonstrated the feasibility of propelling burning fragments capable of producing a burn over a predetermined range and with a predictable area coverage.

Several minor design problems became apparent during the Engineering Design Tests (EDT) conducted 4th Qtr FY68. Review of the total Counter Ambush Weapon Program resulted in the decision to cease any further development of this particular system.

TASK NUMBER: 09-F-66

TITLE: 60MM Hand Directed Mortar

AUTHORIZED FUNDING: \$2,891

TASK DURATION: 22 June 1966 to 25 August 1966

DESCRIPTION AND RESULTS: The 60MM Hand-Directed Mortar (HDM-60) is a light, experimental weapon designed and developed by Watervliet Arsenal in conjunction with the USALWL. The outstanding characteristics of the mortar are its simplicity of design (there are no sighting provisions on the weapon), its light weight (6.8 pounds, excluding ammunition), and its trigger-actuated firing mechanism. It is intended for use by one man, but greater rapidity and accuracy of fire are obtainable when the gunner is assisted by a loader. The trigger-actuated firing mechanism enables the gunner to fire the mortar at 0 degrees elevation, a capability not present in conventional mortars in which the ammunition is fired by the weight of the round falling onto a fixed firing pin.

The HDM-60 was initially developed and safety tested and terminated for lack of any requirement in 1965. A task was established for the preparation of operation and maintenance manuals and to ship these with five (5) mortars and spare parts to Vietnam for operational evaluation. Shipment was made in August 1966. Results of these tests were reported to Army Concept Team in Vietnam (ACTIV) by letter MACSOG, dated 11 Nov 66, Subject: Field Evaluation of 60MM Lightweight Mortar.

TASK NUMBER: 03-F-67

TITLE: Grapnel With Line (Propelled)

AUTHORIZED FUNDING: \$420,503

TASK DURATION: 29 August 1966 to 24 February 1970

CONTRACTOR: Miller Research Corporation

DESCRIPTION AND RESULTS: The purpose of this task was to develop a grapnel system which would meet the specified requirements in the SDR. The developed system expedites the movement of personnel across fast-moving streams and other obstacles such as ravines, canyons, cliffs, and mountainous areas during patrols, raids, and rescue operations. To facilitate carrying, the 25 lb system is divided between two bandoleers - the line bandoleer and the grapnel bandoleer. The line bandoleer contains 400 feet of 5/16" diameter nylon line while the grapnel bandoleer contains the grapnel components, six munitions, safety links, safety lines, goggles and two commercial line-climbing devices. The 4.5 lb grapnel is propelled from a standard M79 Grenade Launcher by a 40mm rocket munition. When fired, the rocket propels the grapnel, which in turn pulls the line a horizontal distance of 175 ft or a vertical height of 150 feet. The system has been designated as the XM1 Launcher Propelled Grapnel with the XM688 40mm Cartridge.

The system underwent Engineering and Service Tests (ET/ST) at Aberdeen Proving Ground, Maryland, and Fort Bragg, S.C. Twelve systems were sent to Vietnam for field evaluation in Apr 70. Funds were provided for preparation of the technical data package to the designated parent agency, Picatinny Arsenal.

TASK NUMBER: 04-F-67

TITLE: 40MM Position Marker (PM-3)

AUTHORIZED FUNDING: \$81,044

TASK DURATION: 7 October 1966 to 27 November 1967

DESCRIPTION AND RESULTS: The 40MM Position Marker (PM-3) is a smoke signal for indicating to overflying aircraft observers the location of troops in areas having a dense jungle canopy. The Marker consists of a case, primer, propellant, projectile body, smoke canister, ogive and a one foot nylon ribbon tether. The smoke canister is tied to one end and the ogive is tied to the other end of the tether. The marker can be launched from either the M79 or the XM148 Grenade Launcher; has a maximum length of 5-1/4 inches and the projectile attains a height of approximately 375 feet. Upon separation of the smoke canister from the projectile body, at the start of descent, the tether deploys and entangles and hangs-up in moderately thick foliage at the top of the canopy. The Tethered-Ogive-Canister configuration minimizes drift from the point of penetration of the canopy and the firing position.

The smoke duration is nominally 1-1/2 minutes. The smoke color and quantity are identifiable from a slant line distance of one mile by aircraft at 1000-3000'. The markers are available with white, red, green or yellow smoke canister. Only the white smoke round has both a day smoke and night flare capability.

Feasibility and prototype development and testing was completed in Jan 67. Engineering Design and Safety Release tests of the 40MM Position Marker (PM-3) were completed in May 67. An evaluation quantity of 510 markers was shipped to Vietnam in Oct 67 for field evaluation.

B-106

TASK NUMBER: 05-F-67

TITLE: Vehicle Smoke Screen System

AUTHORIZED FUNDING: \$24,364

TASK DURATION: 3 November 1966 to 13 September 1967

DESCRIPTION AND RESULTS: This system consists of two mechanically operated smoke grenade dispensers for mounting on the Armored Personnel Carrier (M113). The basic dispenser consists of nine tubes, each tube containing a single AN-M8 smoke grenade. Each dispenser is capable of 180° traverse to provide full coverage for each side of the APC. The grenades are projected to a range of 80-100 feet by a blank cartridge ejection charge.

The system will provide obscuration capability for the APC and may be considered for use with the Command Junk and similar river craft. Tests of a prototype dispenser were completed.

B-107

TASK NUMBER: 06-F-67

TITLE: Armor by the Yard

AUTHORIZED FUNDING: \$8,396

TASK DURATION: 8 December 1966 to 31 August 1967

DESCRIPTION AND RESULTS: Armor-By-The-Yard consists of nylon fabric panels containing armor plates. Each panel is approximately 2 feet wide by 3 feet high, consisting of six nylon fabric pockets. Each pocket contains one 12" x 12" x 1/4" thick XAR-30 steel plate. A rope and grommet seam across the top of the panel provides for attachment of the panel to any supporting structure. This design is intended to provide relatively lightweight, rapidly attached, protective armor for vehicles, boats, and temporary or fixed emplacements.

Twenty armor panels were evaluated in Vietnam as cab area protection for 2-1/2 ton vehicles. As a result of this evaluation, an ENSURE Request for Armor-By-The-Yard panels was submitted to USATAC, the designated parent agency.

TASK NUMBER: 07-F-67

TITLE: Grenade Fuze for Aircraft Deployment

AUTHORIZED FUNDING: \$2,668

TASK DURATION: 6 January 1967 to 27 July 1967

DESCRIPTION AND RESULTS: This task was to determine the feasibility of developing a new fuze for grenades deployed from aircraft. The desired fuze was to have delayed arming and impact functioning. The delay arming feature would insure safer handling when loading on aircraft or when unloading in the case where the system is not used during a mission. Delayed arming would also provide safe clearance from the aircraft when the grenades were dispensed in operational use. Feasibility would be evaluated with both M26 (fragmentation) and M34 (WP) grenades.

An investigation to find an existing fuze which could be modified for this application was not successful. Several concepts for a new fuze were evaluated and considered unsatisfactory from a safety standpoint. Since the development of a complete new fuze would involve time and effort beyond the normal program limits established by this Laboratory, this task was terminated.

TASK NUMBER: 08-F-67

TITLE: Rifle Night Sight

AUTHORIZED FUNDING: \$16,208

TASK DURATION: 31 January 1967 3 May 1968

CONTRACTOR: Kollsman Instrument Corporation

DESCRIPTION AND RESULTS: The Rifle Night Sight is one-half of a 6 x 42 binocular which has been modified for rifle mounting. An illuminated, internally adjustable reticle is incorporated to give a less expensive, more readily available nightsighting device.

Testing was completed on the two feasibility models in 3rd Qtr FY67. The two models, one each for the M14 and M16 Rifles, were made available at USALWL for reference.

TASK NUMBER: 09-F-67

TITLE: Vehicle Gas Tank Armor

AUTHORIZED FUNDING: \$8,818

TASK DURATION: 6 March 1967 to 9 August 1967

DESCRIPTION AND RESULTS: Upon receipt of armor kits in Vietnam, it was found that gas tank protection was also desired. LWL has designed easily mountable retrofit armor kits to cover the gas tanks of 1/4 ton M151 jeeps, 2-1/2 ton M211 and 5 ton M54 trucks. Because of the inaccessibility of the gas tanks, it was not possible to armor the gas tank of the 3/4 ton M37 truck. The 1/4 ton gas tank armor presupposes attaching to the LVAK-2 (LWL Vehicle Armor Kit) used on M151 jeeps. The gas tank armor for 1/4, 2-1/2, and 5 ton trucks was designed and fabricated for shipment to previous armor kit recipients no later than Jul 67.

B-111

TASK NUMBER: 10-F-67

TITLE: Quad 50MG Mount Armor

AUTHORIZED FUNDING: \$1,544

TASK DURATION: 15 March 1967 to 10 August 1967

DESCRIPTION AND RESULTS: An attempt was made to design an armor kit to protect the gunner and loaders of a quad .50 M45 MG mount against small arms attack from close range. It was determined that the only improvement that could be provided over the previously designed M45F bat wings was in the increased level of protection obtainable by fabricating these shields of XAR-30 high hard steel. Upon receipt of requirements from Vietnam, LWL planned to fabricate the number of kits desired.

TASK NUMBER: 11-F-67

TITLE: Position Marker (PM 4)

AUTHORIZED FUNDING: \$49,335

TASK DURATION: 2 June 1967 to 12 March 1969

DESCRIPTION AND RESULTS: The purpose of this program was to prove feasibility, to design, and to develop and test a position marker for day and/or night use that is capable of being hand-launched.

The PM-4 is intended to provide a smoke signal (for daylight use) and/or a flare signal (for night use) for indicating to airborne observers the location of troops operating under dense jungle canopy. Essentially, the PM-4 is a modification of the Hand-Held Position Marker PM-1. The modification consists of replacing the PM-1 smoke canister with a combination smoke/flare canister. In addition, the PM-1 hang-up device is replaced with a cross parachute consisting of 12-inch shroud lines (tied to the canister) and 10-inch "flylines" tied between the chute panels to enhance hang-up capability. Upon being hand-launched, vertically upward, the marker penetrates the jungle canopy and subsequently hangs-up thereon to emit a smoke/flare signal for approximately 100 seconds.

TASK NUMBER: 12-F-67

TITLE: Electrically Initiated Battlefield Illumination System

AUTHORIZED FUNDING: \$21,580

TASK DURATION: 9 June 1967 to 4 April 1968

DESCRIPTION AND RESULTS: The XM 183 Battlefield Illumination System provides two 3-minute periods of illumination when initiated by either of two independent M60 starters. In the electrically initiated system a 6.5 gram charge of Clean Burning Ignition (CBI) powder at the base of each of the twelve individual 40-second illuminating projectiles is electrically initiated with an electric match by a hand-held generator or a DC power source.

When energy is fed into the electric match, a bridgewire ignites an ignition compound which projects hot particles into the CBI charge. When the electric match ignites the CBI charge, several events happen simultaneously. As the CBI charge propels the projectile from a fiberglass launch tube, it ignites a delay charge in the flight delay assembly. The burn time of the delay charge is approximately ten seconds.

The flight delay charge ignites a first fire mix on the aft end of the candle. As the first fire mix lights the candle, the pressure from the burning candle ejects the parachute, which deploys and allows the candle to slowly descend at an approximate rate of six feet per second. Each candle provides an average of 40 seconds illumination at an average of 168,000 candle power. This system will allow an individual to initiate individual projectiles at his discretion at any time interval.

Remote electrical initiation of individual flares by a hand-held generator has been successfully demonstrated. In addition, a new parachute was certified by the success of 109 consecutive parachute deployments. The task results led to Task 04-F-68.

TASK NUMBER: 13-F-67

TITLE: Evaluation of Rocket Guns

AUTHORIZED FUNDING: \$5,116

TASK DURATION: 30 June 1967 to 20 December 1967

DESCRIPTION AND RESULTS: This evaluation was conducted to determine the suitability of small rocket guns for use in special application roles, e.g., very short range, limited target exposure times and situations where low light and/or noise levels are required. Comparison firings were conducted with the 13MM Gyrojet Handgun; the .45 Caliber M1911A1 Pistol; .22 Caliber Colt Pistol, and the .22 Caliber High Standard Pistol (silenced). The comparison areas of interest were ammunition dispersion, system dispersion, individual round lethality, salvo incapacitation probability, sound and light levels and malfunctions.

This evaluation showed that this weapon is not suitable for use in the U. S. Army Limited War Laboratory's special application areas of interest. Its noise level was higher than the silenced .22 caliber weapon, and its light level was excessive. The reliability of the rocket gun was much less than the conventional weapons tested.

TASK NUMBER: 01-F-68

TITLE: 40MM Target Marker (Floating)

AUTHORIZED FUNDING: \$235,315

TASK DURATION: 26 July 1967 to 28 May 1971

CONTRACTORS: Northrop Carolina Inc.; Technidyne Inc.

DESCRIPTION AND RESULTS: The 40mm Target Marker (Floating) TMF-1 is a smoke signal to mark friendly positions, or enemy positions for the application of air fire, in swampy or water-covered areas. The TMF-1 consists of the 40mm, XM195 Cartridge Case, pyrotechnic delay element (fuze), projectile body, smoke canister, ogive, and a combination descent retardation-flotation device. The marker is capable of being shoulder-fired from the M79 or M203 Grenade Launcher. It is 5-1/4" long and has a desired minimum range of 300 meters. The pyrotechnic fuze provides separation of the smoke canister from the projectile body followed by ignition and deployment of the retardation-flotation device. This device provides flotation after impact onto water, mud, or swamp-covered areas. The design goal for smoke signal duration is 90 seconds. Smoke color (red, yellow, and violet) and quantity are identifiable from an aerial slant line distance of one mile on a clear day.

Engineering Design Tests (EDT) for safety evaluation were completed and appropriate quantities fabricated for evaluation in SEA. The designated parent agency was USAMC Project Manager for Selected Ammunition.

TASK NUMBER: 02-F-68

TITLE: Tunnel Weapon

AUTHORIZED FUNDING: \$132,422

TASK DURATION: 9 August 1967 to 27 June 1969

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: This task was to determine the feasibility of providing a multi-projectile, low noise hand weapon for tunnel use. The weapon was to provide improved over-all effectiveness, compared with the conventional handgun, when used in quick-response situations typical of tunnel operations. The tunnel weapon was to fire multi-projectile rounds at reduced sound level and be effective to a range of 50 feet.

A prototype weapon model and experimental multi-projectile rounds were fabricated and feasibility testing conducted. CONUS Safety Evaluation and Performance Testing were completed, and ten weapons and one thousand rounds of ammunition were shipped to RVN 4th Qtr FY69 for field evaluation. The U. S. Army Weapons Command was the designated parent agency for this item.

TASK NUMBER: 03-F-68

TITLE: Silent Sniper System

AUTHORIZED FUNDING: \$163,016

TASK DURATION: 18 August 1967 to 28 April 1971

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The Silent Sniper System was fabricated from the Winchester Model 70 bolt action in .458 caliber, with barrel modified for noise reduction. The ammunition was made from a shortened .458 Magnum Case and uses the standard .458 caliber 500-grain steel jacketed projectile. Muzzle velocity is subsonic and the 500-grain projectile will provide lethal energy at longer ranges. The sight system is the Adjustable Ranging Telescope with the ballistic cam tailored to the ballistics of the 500-grain projectile. An adaptor mount base permits mounting the Starlight Scope for night use. The weapon, with scope mounted, weighs 14-1/2 pounds and is 45 inches long. The firing signature should be essentially inaudible beyond 100 meters. The loading capacity is three rounds in the magazine and one in the chamber.

Five systems with ammunition and instruction manuals were shipped to RVN in 3d Qtr FY71 for field evaluation.

B-118

TASK NUMBER: 04-F-68

TITLE: Remote Controlled Rocket Flare

AUTHORIZED FUNDING: \$75,423

TASK DURATION: 19 March 1968 to 5 December 1968

CONTRACTOR: Thiokol Chemical Corporation

DESCRIPTION AND RESULTS: The original project started primarily as a self-contained perimeter illumination rocket for base camps, strategic hamlets, and company-size units. It was also conceived that the rocket was readily adaptable as a standoff illumination rocket for use with rotary wing aircraft. Propulsion was provided by a solid propellant rocket motor, horizontal range was 600 meters, deployment elevation was 800 feet, candlepower was 300,000 candles for a minimum of one minute. During Phase I or development, the requirements were changed to a design to be used primarily as air-launched standoff illumination for rotary wing aircraft and secondary usage was for ground-launched perimeter illumination.

In November 1968, a letter was received from HQS, USARV requesting that a 2.75" Illumination Warhead be developed for the 2.75" FFAR instead of the Remote Controlled Rocket Flare. As a result of this letter, a stop order was placed on the project and a new project was initiated to meet the request of USARV (Task 07-F-69). Task 04-F-68 was later reactivated under 06-F-70 at request of the U. S. Air Force.

B-119

TASK NUMBER: 05-F-68

TITLE: Helicopter "Flak Cover" - Feasibility Investigation

AUTHORIZED FUNDING: \$21,211

TASK DURATION: 11 April 1968 to 13 December 1968

DESCRIPTION AND RESULTS: A series of lightweight, water, mildew and fungus resistant flak blankets was developed and tested as an interim measure to protect parked helicopters from low velocity shell fragments. Each multilayer ballistic nylon blanket weighs 25 pounds and measures 37" x 53" over-all. It provides protection over a 30" x 48" area against over 80% of the fragments which might be produced by a mortar or rocket exploding nearby. The overlapping edges are provided with grommets on two sides and matching fasteners on opposite edges. Ninety flak blankets were shipped to RVN in December 1968 for field evaluation.

B-120

TASK NUMBER: 06-F-68

TITLE: Adjustable Ranging Telescope Procurement

AUTHORIZED FUNDING: \$40,737

TASK DURATION: 1 May 1968 to 24 October 1968

DESCRIPTION AND RESULTS: This task is described in Task 05-F-66.

B-121

TASK NUMBER: 07-F-68

TITLE: Back-Pack Ammunition Feed System for the M60 Machine Gun

AUTHORIZED FUNDING: \$38,747

TASK DURATION: 6 May 1968 to 27 June 1969

DESCRIPTION AND RESULTS: The Back-Pack Ammunition Feed System provides the individual machine gunner with 400 rounds of 7.62MM ammunition. The major components of the system are a standard back-pack, a reel-type ammunition container, and flexible ammunition chuting. The total weight of the system including ammunition is 36 pounds. The system can be fired from all standard firing positions with no restriction to the field of fire. Seventeen systems, spare parts and Operator's Manuals were shipped to RVN for evaluation during the 4th Qtr FY69.

B-122

TASK NUMBER: 01-F-69

TITLE: Trip Flare Initiator, Electric

AUTHORIZED FUNDING: \$5,270

TASK DURATION: 8 August 1968 to 12 November 1968

DESCRIPTION AND RESULTS: This concept involved a small clip-on device which, when attached to the M49 Trip Flare, could be used to function the flare electrically. The device would not interfere with the trip function feature. By having the option to remotely trip the flare electrically, it could be used: (1) For nominal surface illumination before aerial flares are deployed, (2) as perimeter identification for aerial support fire, (3) to illuminate a perimeter if it were felt that infiltrators had bypassed the trip wire system, and (4) for kill zone illumination in an ambush.

Initial design work was completed and several prototype devices were fabricated and successfully tested. This program was cancelled because of the lack of a firm field requirement for the item.

TASK NUMBER: 04-F-69

TITLE: Evaluation of Mini Grenade

AUTHORIZED FUNDING: \$20,224

TASK DURATION: 6 September 1968 to 28 April 1969

DESCRIPTION AND RESULTS: The 136 gram Mini Hand Grenade V40, produced by the NWM firm of Holland, is a spherical fragmentation grenade 1-1/2 inches in diameter and 2-1/4 inches long. The contour-hugging safety lever is held by a double-acting safety pin which requires 7 to 10 in. lbs. twist plus 2 to 6 pounds pull for extraction. The V40 Mini Grenade has a removable sealed detonator which provides $4 + 1/2$ second delay before initiation of the 34 gram Comp B explosive filler. The 78 gram (2.8 oz) spherical steel body is internally grooved into 326 squares and, like the 40MM M406 HE projectile, produces about 320 lethal fragments over an area 10% to 20% less than that of the M406. Maximum fragment range is 20 to 25 meters. Throwing accuracy for the 4.8 oz V40 is equal to the 16 oz M30 Practice (or M26 HE) Grenade, but the V40's throwing range is 60 to 75 meters, which is 15 meters greater than that of the M30.

No premature functions or other unsafe conditions were found during the testing of 101 Mini Grenades in hot and cold storage, 14 day Tem-Hum Jan cycle, 40 foot drop and vibration tests. In addition to the 101 grenades tested after special conditioning, 23 other grenades were tested with no conditioning. One grenade from each group failed to function. A Safety Statement was issued for this item. Information on test results was forwarded to OCRD with recommendations for continuation by AMC.

TASK NUMBER: 05-F-69

TITLE: Suppressive Fire Weapon System for Helicopters

AUTHORIZED FUNDING: \$202,557

TASK DURATION: 18 November 1968 to 10 May 1971

CONTRACTOR: MRC Corporation

DESCRIPTION AND RESULTS: This system will provide troop-carrying helicopters with an immediate, close-in, forward area suppressive fire capability during landing and take-off in combat operations. It is a lightweight modular weapon mounted on the front of UH-1D/H helicopters, with start-stop firing controlled by either the pilot or copilot. The system consists of four modules Caliber .22 Multiple Barrel Gun XM215, (also used in the Counter Ambush Barrage Weapon System XM55), a module mount, firing and control consoles, and associated cables and wiring harness. Each module contains 306 barrels which are oriented to provide a pyramidal cone of fire. With the four modules, a barrage of sequential fire is obtained over a 15° vertical and 40° horizontal zone to the front of the helicopter. Selection between three firing rates provides 10 seconds of fire at 7200 shots per minute, 20 seconds at 3600 spm, or 40 seconds at 1800 spm. The anticipated request for RVN evaluation did not materialize, thus the four systems remained available for evaluation in CONUS or OCONUS.

TASK NUMBER: 06-F-69

TITLE: Mine Clearance Feasibility Study

AUTHORIZED FUNDING: \$5,737

TASK DURATION: 25 November 1968 to 27 June 1969

DESCRIPTION AND RESULTS: The results of this study showed that it was not feasible to propel enough detonating cord to clear mined paths of booby traps and AP mines due to the limits of what a soldier can carry. For clearing trip wires only, a 9.3 ounce Trip Wire Snagging Device (TWSD) was developed. The 40MM TWSD, when propelled at a launch angle of 10 degrees to 20 degrees over the path to be cleared, whether in open terrain or in a wooded area, will attain a range of about 70 meters unless it strikes an obstruction. If drawn back at a moderate rate, the cup saw ogive of the TWSD should snag and trip or cut at least 80% of trip wires strung from ground level to one or more meters above the ground in relatively open terrain. In wooded or heavily grassed areas, the probability of snagging all trip wires along the path is about 50% based upon limited tests at Aberdeen Proving Ground, Maryland.

Investigations of several projectiles, snagging devices and types of line for maximum TWSD projection range have been completed. At least 30 of the proposed type of TWSD's were tested in open and wooded terrain, and 24 prototype devices were fabricated for OCONUS evaluation. Drawings to permit fabrication of this field expedient device in rear echelon shops were prepared. Twenty-four TWSD's were shipped to RVN for evaluation in May 1969. The designated parent agency for this item was the Project Manager for Selected Ammunition.

B-126

TASK NUMBER: 07-F-69

TITLE: Illumination Warhead, 2.75" Rocket

AUTHORIZED FUNDING: \$430,344

TASK DURATION: 5 December 1968 to 30 August 1973

CONTRACTOR: Thiokol Chemical Corporation

DESCRIPTION AND RESULTS: The 2.75 Inch Illumination Warhead requested by USARV Aviation and HQ, MASSTER, utilizes the standard 2.75 Inch FFAR as the source of propulsion. Any Army aircraft capable of firing rockets from the M157B, M159C or M200 launchers can carry and fire this warhead. The warhead is 28.6 inches long and weighs 10.8 pounds. When coupled with the rocket motor, the overall length is 67.9 inches and the total weight is 21.7 pounds. The illuminant composition produces an excess of one million candles over a circular area approximately 1000 meters in diameter with a minimum ground light level of 0.2 footcandles. The circular light pattern provides a very stable white light which produces excellent resolution of ground objects. A flare composition is insensitive to small arms ballistic impacts 70 percent of the time. Should ignition occur from a ballistic impact, there is no explosion or detonation.

The warhead has a standoff range of approximately 2900 meters. The burn time is 110-120 seconds and the average descent velocity is 13.5 feet per second.

A field evaluation conducted in RVN with the night air TOW helicopter and the night area surveillance and interdiction operations (Nighthawk) was successful. In addition, the warhead was evaluated by MASSTER and found acceptable except that a longer range was desired for their mode of deployment. Thirty-six warheads were modified for the MASSTER requirement and delivered during June 1973.

B-127

TASK NUMBER: 09-F-69

TITLE: Sling Adaptors for the M-16 Rifle

AUTHORIZED FUNDING: \$8,616

TASK DURATION: 29 January 1969 to 6 August 1969

DESCRIPTION AND RESULTS: The Sling Adaptor Kit provides mounting hardware for fastening the rifle sling on the top of the weapon. This mounting arrangement makes it possible for the user to carry the M16 Rifle slung over the shoulder, muzzle pointed to the front, in the ready-fire position. The adaptor components weigh approximately one ounce and can be easily installed on any standard M16 Rifle or M16/M203 Grenade Launcher combination. Five hundred kits with installation instructions were shipped to RVN during 4th Quarter FY69. Project Manager, Rifles, USAMC, the designated parent agency procured an additional quantity for RVN issue.

B-128

TASK NUMBER: 10-F-69

TITLE: Bright Light Mob Dispersal (RC)

AUTHORIZED FUNDING: \$23,883

TASK DURATION: 27 February 1969 to 10 February 1970

CONTRACTOR: Thiokol Chemical Corporation

DESCRIPTION AND RESULTS: The light source is a reflector-equipped hand-held device utilizing a high-intensity pyrotechnic illumination candle. The hand-held device utilizes a standard plastic right-angle-head flashlight. The head containing the bulb and reflector is removed and an adaptor which contains the candle and disposable reflector is attached. The flashlight is used to initiate the candle. The output of the candle is a minimum of 300,000 candles and burns a minimum of one minute. The light was to be designed to temporarily blind the mob participants by the high-intensity light causing confusion and therefore destroying the unity of the mob.

Tests were conducted which indicated that the item did not produce the desired effect on the viewers. The light was suitable for area illumination but did not disturb the viewers or cause temporary blindness. As a result of these tests, this project was terminated.

TASK NUMBER: 01-F-70

TITLE: Reticle Illumination Adapter Kit (RIAK)

AUTHORIZED FUNDING: \$2,415

TASK DURATION: 31 July 1969 to 9 January 1970

DESCRIPTION AND RESULTS: The RIAK was a controlled-intensity, battery-powered incandescent illumination system for illuminating the reticle of the Adjustable Ranging Telescope. The system was in kit form to adapt to the ART without modifying the telescope. The control switch, a ribbon switch fastened to the pistol grip of the rifle stock, was operated by finger pressure from the trigger hand.

A prototype system was fabricated and tested under dusk-to-dark conditions. This test indicated that there was little to be gained by illuminating the reticle, as the limiting criterion is the ability to identify a target through the optical system. Therefore, the project was cancelled.

TASK NUMBER: 02-F-70

TITLE: Directional Light, Pyrotechnic

AUTHORIZED FUNDING: \$10,480

TASK DURATION: 31 July 1969 to 13 October 1971
Reopened: 19 December 1972 to 27 February 1974

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The Ambush Light (Pyrotechnic) is intended to provide combat troops with the capability of lighting ambush kill zones. The light source is a high-intensity pyrotechnic illumination candle contained in a collapsible, disposable and camouflaged, light-directing shield. The shield is conical in shape and is approximately nine inches long and 11 inches across the face when open. The light is initiated by the M57 Electrical Firing Device from distances up to 100 feet and provides 50,000 candlepower of illumination for a period of one minute. Two hundred units were fabricated and shipped to RVN for evaluation.

TASK NUMBER: 03-F-70

TITLE: Trip Wire Snagging Device (Improved)

AUTHORIZED FUNDING: \$16,595

TASK DURATION: 24 November 1969 to 18 September 1970

DESCRIPTION AND RESULTS: The feasibility of projecting and retrieving a Trip Wire Snagging Device (TWSD) was demonstrated with an M79 (40mm) projected device. This improved TWSD task investigated methods of improving the snagging capabilities, reducing skip over trip wires, and preventing line breakage when excessive snag loads occur. Different projection methods, including the use of the M16 Rifle, were considered. The snagging device was capable of penetrating light foliage during retrieval, and the attached line had sufficient strength to retrieve the snagging device through light brush. The Improved TWSD was capable of being launched from standard weapons (M203 Grenade Launcher and/or the M16 Rifle).

B-132

TASK NUMBER: 04-F-70

TITLE: Quiet, Special-Purpose Revolver

AUTHORIZED FUNDING: \$127,727

TASK DURATION: 19 January 1970 to 17 October 1972

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The Quiet, Special-Purpose Revolver (formerly the Tunnel Weapon) is a modified .44 Magnum six-shot, double-action revolver. The chambers in the cylinder have been enlarged to accept the special multi-projectile cartridges which are fired at a reduced sound level. It is designed to fill the need for a low-noise handgun for use in quick-response, close-in situations usually encountered in tunnel operations. The multipellet cartridge gives effective fire capability in those situations where there is no time for point or aim firing. It also improves the capability of the user who is not a proficient pistol shot. This weapon was evaluated in Vietnam and some problems in the over-all system performance were reported.

TASK NUMBER: 05-F-70

TITLE: Hand-Held Grenade Launcher

AUTHORIZED FUNDING: \$5,489

TASK DURATION: 23 January 1970 to 10 September 1970

DESCRIPTION AND RESULTS: The M79 40mm Grenade Launcher was subjected to a field modification in Vietnam. The barrel of the weapon was shortened and the shoulder stock was cut down to the pistol grip. However, when this modified weapon was fired, the weapon safety cut the shooter's hand. The LWL program was to design a pistol-type grip to replace the cut-off shoulder stock. The developed grip has a flare on the upper part to prevent it from sliding through the hand. The grip is made of aluminum to partially replace the weight lost from removal of the shoulder stock.

A quantity of the hand grips was fabricated and shipped 17 Jul 70, with installation manuals, to the 5th Special Forces Group in RVN for field use. A letter report from the field showed the HAGL was well received and recommended incorporation into the Army inventory.

TASK NUMBER: 06-F-70

TITLE: RIPER (Army)

AUTHORIZED FUNDING: \$23,222

TASK DURATION: 22 May 1970 to 12 July 1971

CONTRACTOR: Thiokol Chemical Corporation

DESCRIPTION AND RESULTS: An interim night capability was required for the TOW and DRAGON missiles until the night vision devices were developed. A ballistic analysis was conducted to determine the feasibility of increasing the range of RIPER to meet the range requirements of TOW and DRAGON. The study revealed that the present design could be modified to meet the extended range requirements. Sixteen Air Force RIPER projectiles were successfully demonstrated at Fort Benning, Georgia, to show the capability of RIPER to illuminate targets and successfully track the targets with the TOW daylight sights.

TASK NUMBER: 07-F-70

TITLE: 105MM Subcaliber Training Device

AUTHORIZED FUNDING: \$100,210

TASK DURATION: 22 May 1970 to 1 February 1973

DESCRIPTION AND RESULTS: The 105mm Subcaliber Training Device simulates the 105mm shell and is used to train tank gunnery crews in gunnery and crew coordination procedures. The use of the .50 caliber spotter tracer round in the 105mm subcaliber training device allows training to be conducted at training areas which have range limitations that do not permit main gun firing. In addition, each .50 caliber spotter tracer round costs less than \$1.00, a substantial cost reduction over the 105mm round.

Accuracy and dispersion tests consisting of firing 90 rounds at 500 and 1500 yards from the M60 Tank gun were accomplished. Five 105mm Subcaliber Training Devices were manufactured and shipped with 1000 subcaliber round assemblies to USAREUR for field evaluation.

TASK NUMBER: 08-F-70

TITLE: Hand-Held Position Marker (PM-4) - RVN Evaluation Quantity

AUTHORIZED FUNDING: \$13,079

TASK DURATION: 26 May 1970 to 10 December 1970

DESCRIPTION AND RESULTS: The Hand-Held Position Marker (PM-4) is a combination smoke/flare signal for indicating to overflying aircraft observers, in daylight or at night, the location of troops in areas having a dense jungle canopy. The PM-4 is a modification of the Signal, Ground, White Star, M127A1. This modification consists of replacing the signal canister with a combination smoke/flare canister to provide night as well as daytime capability. In addition, the stabilizing fins are modified, the payload expulsion delay element is shortened, and the parachute is replaced with a cross-parachute consisting of 12-inch shroud lines (tied to the canister) and 10-inch "flylines" tied between the chute panels to enhance hang-up capability.

The PM-4, which is hand-launched vertically upward, is 10 inches long and 1.65 inches in diameter. The rocket-boosted canister will attain a height of approximately 350 feet. At this altitude, which is attained approximately 2-1/2 seconds after launch, the canister is ignited and simultaneously separated from the rocket booster. At the start of descent, the hang-up device (chute) deploys and entangles and hangs-up in moderately thick foliage at the top of the canopy. The smoke/flare mixture burns for a duration of approximately 90 seconds with a yellow white brilliance emitting a fairly dense white cloud of smoke. The PM-4 weighs approximately one pound. One hundred fifty markers were shipped to RVN for evaluation in 2d Qtr FY71.

TASK NUMBER: 09-F-70

TITLE: One-Half Size Smoke Grenade

AUTHORIZED FUNDING: \$44,981

TASK DURATION: 30 June 1970 to 14 October 1971

DESCRIPTION AND RESULTS: This task, in response to the need for a grenade of less weight and bulk than the M18, originally involved a smoke grenade, the body of which was a can one-half the size of the M18 can. At the same time, in a parallel effort, LWL developed the "Midi" smoke grenade which was superior to the half-size in all respects, thus development of the half-size was terminated.

The LWL "Midi" Smoke Grenade is 1-1/2" diameter x 4" high over-all. Its total weight is 7 ounces including the standard fuze M201A1. Burn time for the Midi exceeds 60 seconds and the smoke volume produced is at least equivalent to that of 40mm Target Markers. The available smoke colors are red, yellow and violet and are identified for each grenade by the color of the tape on top of the grenade body. The Midi is approximately the same size as 40mm ammunition, thus these smoke grenades can be carried in the 40mm ammunition bandoleer. Three hundred Midi Smoke Grenades were shipped in May 71 for RVN evaluation.

TASK NUMBER: 10-F-70

TITLE: Launcher Improvement for Illumination System Flare, Surface: Parachute XM183

AUTHORIZED FUNDING: \$70,500

TASK DURATION: 22 September 1970 to 12 June 1972

CONTRACTOR: IIT Research Institute

DESCRIPTION AND RESULTS: The XM183 Parachute Surface Illumination System Flare is a lightweight, self-contained illumination system to provide close-in illumination for night operations by combat units varying in size from a listening post to a company. The system operates on the sequential mortar-type expulsion of twelve fin-stabilized parachute flare rounds. The launch tubes are arranged in three rows of four tubes each, presenting three separate vertical and four horizontal bore centerline impulse positions. Proper transmission to the ground of the recoil energy from these impulses was not accomplished in the original system launcher. The resultant instability of the launcher caused erratic round flights. As a result of an In-Process Review (IPR) held in Apr 70, USALWL was directed to redesign the launcher to correct the deficiencies and submit it to Check Tests.

The feasibility of replacing the unacceptable aluminum frame, scissor-leg launcher with a wire-form was shown by an in-house task at USALWL. Limited testing proved that the engineering concepts utilized in it were effective in maintaining the necessary launch stability. The wire form fits around the flare package and has a stamped and formed aluminum baseplate with adjustments for three angles of fire depending on ambient temperature conditions. Two angle stakes through the baseplate and two wire form stakes through the front legs secure the launcher in all types of ground from sandy through hard-packed soil or clay.

One-hundred seventy five launchers were manufactured by a wire form company to the new design and successfully tested both by the acceptance test fixture and actual firings.

TASK NUMBER: 01-F-71

TITLE: Nonsubmersible Smoke Grenade

AUTHORIZED FUNDING: \$159,527

TASK DURATION: 17 July 1970 to 12 June 1972

CONTRACTOR: Northrop Carolina Inc.

DESCRIPTION AND RESULTS: The standard smoke grenades, AN/M8 and M18, will not provide suitable smoke when thrown into water or deep snow because the emission port is below the water level or snow surface. When dropped from an aircraft, the standard grenades bury themselves in the mud or deep snow. A means for slowing the descent rate and a flotation capability is required. This requirement was cited by the U. S. Army in Vietnam and in Alaska.

On the Nonsubmersible Smoke Grenade the standard AN/M8 Smoke Grenade can and fuze are used, making the item usable in a smoke grenade dispenser such as that on the Cobra helicopter.

The standard can is split into two sections about one-third of the way down from the top. A bulkhead, with a chimney/ballute assembly attached, is crimped across the bottom two-thirds of the can. The top one-third of the standard can with the standard size fuze is then positioned over the deflated ballute assembly and the can is taped together with a waterproof vinyl tape. A short piece of nylon tether cord is attached to the top third of the can and held under the tape on the bottom two-thirds of the can. When actuated, the fuze initiates a first fire mix on the smoke composition in the bottom two-thirds of the can with the fuze to be separated from the bottom part of the can.

The burning smoke composition gases inflate the ballute immediately and the large area thus presented retards the descent of the grenade preventing it from burying in the mud, in shallow water or impacting with enough force to bury in soft ground or break up on hard ground. The inflated ballute also causes the grenade to float well enough on even rough water to give a full, unfiltered smoke emission. The grenade is made in five colors: white, red, green, yellow, and violet. Four hundred eighty each Floating Smoke Grenades were delivered to U. S. Army Alaska for user field evaluation.

TASK NUMBER: 02-F-71

TITLE: 40MM Floating Flare

AUTHORIZED FUNDING: \$210,508

TASK DURATION: 17 July 1970 to 27 February 1974

CONTRACTORS: Chemtronics; Northrop Carolina Inc.

DESCRIPTION AND RESULTS: The 40mm Floating Flare is a fixed round which is deliverable from the M79 and M203 grenade launchers and used for nighttime target or position marking in inundated areas or snow. The external configuration is similar to the 40mm Target Marker (Floating), TMF-1, a smoke signal, and the M583 White Star Parachute Cartridges. A deflated doughnut-shaped ballute is incorporated in the canister. After firing, the cartridge gases inflate the ballute which serves to retard the fall of the round and to provide an upright floating surface. The flare burns from a chimney which extends through the center of the ballute. The signals are identifiable from a range of 3,000 meters at an altitude of 1,000 feet on a clear night.

A small quantity of flares was demonstrated to USARAL. They recommended that this round be included in the Army inventory for use in snow. Twelve hundred flares were delivered to USALWL for future testing and evaluation.

Three hundred flares were supplied to USARAL for field evaluation. Nine hundred flares were furnished for tests as required to collect information for type classification.

TASK NUMBER: 03-F-71

TITLE: Pursuit Deterring Munition

AUTHORIZED FUNDING: \$99,656

TASK DURATION: 4 August 1970 to 29 June 1973

CONTRACTOR: Breed Corporation

DESCRIPTION AND RESULTS: The Pursuit Deterring Munition was requested by reconnaissance patrols operating behind enemy lines. This munition would be used during the withdrawal operation after the team has been detected and is being pursued by the enemy. Feasibility was shown with a munition two inches in diameter and six inches long which contained a seismic sensor. Since false alarms are characteristic of seismic sensors, a sensing system which will not false alarm is needed. Several air munitions were developed in DOD which contain logic circuitry which overcome false alarming. LWL monitored these programs for the possibility of including the logic circuitry into the Pursuit Deterring Munition. This program was held in abeyance until a decision can be made concerning the inclusion of the logic circuitry into the Pursuit Deterring Munition and eventually terminated.

TASK NUMBER: 04-F-71

TITLE: Mortar Aiming Device, 60MM

AUTHORIZED FUNDING: \$105,742

TASK DURATION: 8 August 1970 to 19 October 1973

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The Aiming Device provides elevation and azimuth sensing for the 60mm Hand-Held Mortars. A quadrant-type elevation scale and a gravity-sensitive indicator is used to sense elevation and a device which maintains reference to the earth through a mechanical link senses azimuth. The elevation and azimuth sensing devices are contained in a single lightweight clamp-on unit. An integral holding/carrying handle is also provided.

The Aiming Device was demonstrated to the Mortar Committee at Ft. Benning, GA, in May 73. They expressed interest in including this concept in the Lightweight Company Mortar then under development.

TASK NUMBER: 05-F-71

TITLE: Silenced Pistols and Rifle

AUTHORIZED FUNDS: \$5,792

TASK DURATION: 14 September 1970 to 15 March 1971

DESCRIPTION AND RESULTS: Silencers (noise suppressors) were required on auto-loading pistols and AK47 Rifles for special use. Six AK47 Rifles were provided by the requestor, and ten Walther PPKS auto-loading pistols in 7.65mm (.32 ACP) and 9mm Corto/Kurz (.380 AP) caliber were procured. To mount noise suppressors on the AK47 Rifles, it was necessary to relocate the front sight. To mount the noise suppressors on the Walther pistols, it was necessary to replace the barrels to provide a mounting area for the suppressor. Six AK47 Rifles and four each of the Walther PPKS Pistols in 7.65mm and 9mm Corto/Kurz calibers were shipped to RVN in 3d Qtr FY71 for evaluation by the requestor.

TASK NUMBER: 06-F-71

TITLE: Waterways Harassment and Interdiction Mine

AUTHORIZED FUNDING: \$79,304

TASK DURATION: 19 October 1970 to 3 March 1972

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The WHIM is a small tethered floating mine which was designed to saturate selected areas of specific waterways. When a floating steel drum contacts a mine, magnetic attraction initiates the firing sequence and the explosive charge is directed into the supply. One such contact and initiation is sufficient to sink the supply.

The prototype design was improved and limited testing was satisfactorily conducted under dynamic conditions. Fifty units of the improved design were fabricated for safety evaluation testing. The task was terminated because funding support expected from the sponsor did not materialize.

TASK NUMBER: 08-F-71

TITLE: Helicopter Dropsight

AUTHORIZED FUNDING: \$35,749

TASK DURATION: 9 June 1971 to 27 February 1974

DESCRIPTION AND RESULTS: A simple sighting device was developed for use when hand dropping various hardware including unattended ground sensors from UH-1D and UH-1H helicopters. The initial concept consisted of a simple cross hair mounted in a ring that projects outside the helicopter on an arm that was attached to a standard installed in the rear doorway. The sight could be adjusted by the user for various drop conditions (various payloads, altitudes, flight speeds, etc.). Sighting was accomplished by alignment of the cross hair, a mark on the helicopter skid, and the drop zone. When all items were in line, the hardware was hand dropped. This item also could be used with a dispenser.

An improved model was evaluated at Fort Huachuca and a request was made for twelve Dropsights for use in training at the Combat Intelligence Schools. Twelve Dropsights were fabricated and shipped to Fort Huachuca in June 1973.

TASK NUMBER: 01-F-72

TITLE: Less Lethal Ammunition for Small Arms

AUTHORIZED FUNDING: \$207,669

TASK DURATION: 11 August 1971

DESCRIPTION AND RESULTS: Various existing concepts were reviewed. Selected available hardware was being tested and new items were developed and tested. The more promising munitions were subjected to physiological testing prior to selection of the best less lethal munitions for the various scenarios of employment. These were then offered to potential users for field evaluation.

B-147

TASK NUMBER: 02-F-72

TITLE: Plastic 5.56MM Blank Cartridge Feasibility Study

AUTHORIZED FUNDING: \$121,554

TASK DURATION: 30 August 1971 to 30 April 1974

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The LWL concept was to determine the feasibility of developing a plastic 5.56mm blank cartridge requiring the minimum amount of brass. The cartridge is all plastic except for the primer, a small primer holder, and the propellant. This cartridge is of the same basic dimensions as standard 5.56mm ammunition. It was designed for use in the M16 Rifle and other weapons using the 5.56mm cartridge.

A single-cavity injection mold was made and a plastic blank cartridge case developed. One thousand rounds were delivered to USALWL during the 4th Qtr FY 73. After an evaluation was completed, a contract was awarded for 40,000 rounds for EDT and field evaluation.

TASK NUMBER: 03-F-72

TITLE: Modified Grapnel With Line

AUTHORIZED FUNDING: \$131,415

TASK DURATION: 10 September 1971 to 27 February 1974

DESCRIPTION AND RESULTS: The grapnel system consists of a grapnel hook, nylon line and a rocket motor which propels the grapnel hook approximately 220 feet horizontally or 150 feet vertically. To facilitate carrying, the grapnel system is divided into two bandoleer assemblies: The line bandoleer and the grapnel bandoleer. The line bandoleer contains 400 feet of 5/16" diameter nylon line and a gas deflector. The grapnel bandoleer contains the grapnel components, six munitions, two safety lines, goggles and two commercial line-climbing devices. Upon firing, the rocket motor in the munition propels the grapnel, which in turn pulls the line.

The grapnel with line was modified to eliminate shortcomings and deficiencies which appeared during ET/ST tests. In addition, the grapnel system was modified so it can be launched from either the M79 or the M203 grenade launchers. Check Tests on the M79 and ET/ST on the M203 were completed in Oct 73. An IPR was held and project responsibility was turned over to the parent agency (Picatinny Arsenal).

TASK NUMBER: 04-F-72

TITLE: Arctic Tent Stake Driver

AUTHORIZED FUNDING: \$73,858

TASK DURATION: 1 October 1971 to 27 February 1974

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The purpose of this task was to design and develop a lightweight, low-cost, hand driven stake for Arctic use. Prototypes were fabricated and tested initially in representative frozen soils and later in Alaska.

Previous effort on a stake driver indicated it was not practical to drive available stakes mechanically and that a special stake similar to the tubular ice piton was required. Several functional, cost-saving, hand-driven tent stakes were designed and fabricated and tested in frozen soil simulations. Prototypes of the two successful designs were sent to Alaska for field evaluation.

B-150

TASK NUMBER: 05-F-72

TITLE: MIDI Smoke Grenade

AUTHORIZED FUNDING: \$69,456

TASK DURATION: 24 February 1972 to 30 June 1973

DESCRIPTION AND RESULTS: The Midi Smoke Grenade is 1-1/2 inch diameter and 4 inches high overall. Its total weight is 7 ounces including the standard M201A1 Fuze. Burn time for the Midi exceeds 60 seconds and the smoke volume produced is at least equivalent to that of 40mm Target Markers. The available smoke colors are red, yellow, violet, and green. The Midi is approximately the same size as 40 mm ammunition; thus these smoke grenades can be carried in the 40mm ammunition bandoleer. Edgewood Arsenal continued the effort for eventual type classification of the Midi to replace the M18 on a one-for-one basis.

TASK NUMBER: 20-F-72

TITLE: Illumination Warhead, 2.75 Inch Rocket

AUTHORIZED FUNDING: \$37,938

TASK DURATION: 17 December 1971 to 21 July 1972

CONTRACTOR: Thiokol Chemical Corporation

DESCRIPTION AND RESULTS: The 2.75 Inch Illumination Warhead requested by USARV Aviation utilizes the standard 2.75 Inch FFAR as the source of propulsion. Any Army fixed or rotary wing aircraft capable of firing rockets from the M157B, M159C, or M200 Launchers can carry and fire this warhead. The illuminant composition produces an excess of one million candela which effectively lights a circular area approximately one kilometer in diameter. The light pattern is circular and provides a very stable white light which produces excellent resolution of ground objects. The flare composition is insensitive to small arms ballistic impacts 70 percent of the time. Should ignition occur from a ballistic impact, there is no explosion or detonation.

The warhead has a standoff range of approximately 2900 meters from the point of launch to parachute deployment and candle ignition and requires approximately ten seconds to complete the trajectory.

A total of 103 warheads were fired successfully from a Cobra, of which 19 were night firings, on the Pyrotechnic Evaluation Range at Yuma Proving Ground. The Engineering Design and Environmental Tests were completed in October 1971 and revealed several problem areas in the warhead. A program to correct the problem areas and rerun the rough handling tests was successfully completed and 100 warheads were shipped to MASSTER for evaluation in their TRICAP program. An urgent request for these 100 warheads was received from ACSFOR in late May 1972, and these 100 warheads were diverted from MASSTER and shipped to RVN in June 1972.

TASK NUMBER: 01-F-73

TITLE: Illuminate Spectrum Analysis Study

AUTHORIZED FUNDING: \$56,890

TASK DURATION: 24 July 1972 to 27 February 1974

CONTRACTOR: Thiokol Chemical Corporation

DESCRIPTION AND RESULTS: This project evaluated by instrumentation and visual comparative methods a new illuminant to provide better target acquisition, target resolution, and target reflectivity by the naked eye. The standard 81mm Mortar Illuminating Projectile was used as the vehicle for the visual comparison test. Comparative evaluations were successfully completed and a demonstration of the test vehicles, to user representatives, was conducted.

B-153

TASK NUMBER: 02-F-73

TITLE: Less Lethal Liquid Ball

AUTHORIZED FUNDING: \$134,733

TASK DURATION: 24 July 1972 to 26 April 1974

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The LWL Liquid Ball developed under a previous task shows potential as an effective means of controlling disorderly persons without causing unacceptable physical damage, but the trade-offs between effectiveness and low-lethality had not been made.

The purposes of this task were to determine the physiological effects, to improve the accuracy, and to determine optimum projectile size and weight of the Liquid Ball.

B-154

TASK NUMBER: 03-F-73

TITLE: Line Source Smoke and Riot Control Agent Rope

AUTHORIZED FUNDING: \$103,839

TASK DURATION: 1 August 1972 to 22 April 1974

CONTRACTOR: Ensign Bickford Company

DESCRIPTION AND RESULTS: The line source smoke and riot control agent rope is essentially a thin plastic tube filled with the required chemicals which will provide a quick burner of riot control agent. It is approximately 5/16 inch in diameter and weighs approximately .03 pounds per foot. It may be made in any length; however, the standard package is 250 feet.

A contract to manufacture smoke rope was awarded and Engineering Design Tests were completed. An IPR was held and project responsibility was turned over to the Parent Agency (Edgewood Arsenal).

TASK NUMBER: 04-F-73

TITLE: 2.75 Inch Multishot Antitank Warhead

AUTHORIZED FUNDING: \$73,189

TASK DURATION: 1 August 1972 to 27 February 1974

CONTRACTOR: Thiokol Chemical Corporation

DESCRIPTION AND RESULTS: The purpose of this task was to conduct a feasibility study to determine the area coverage and probability of stopping an armored vehicle with BLU-7A/B shaped charge bombs. Six (6) BLU-7A/B bombs were nested as a cluster of six (6) submunitions into a warhead capable of being mated to a 2.75 Inch FFAR motor. The WDU-4A/A fuze used in the 2.75 Inch Illumination Warhead was used for separating the warhead from the rocket motor. The feasibility study was successfully completed.

TASK NUMBER: 05-F-73

TITLE: Chaff Warhead, 2.75 Inch FFAR

AUTHORIZED FUNDING: \$139,448

TASK DURATION: 1 August 1972 to 27 February 1974

CONTRACTOR: Tracor, Inc.

DESCRIPTION AND RESULTS: The purpose of this task was to design and develop a chaff dispensing warhead which will provide a helicopter with the capability of dispensing clouds of chaff along a two mile line. The warhead utilizes as much as possible existing and proven hardware from the 2.75 Inch FFAR Flare Warhead. The standard M200 19-tube dispenser is utilized as the launcher for the warhead.

Radar Cross Section effectiveness tests were conducted as were flight tests to determine the effectiveness of the warhead. The warhead was turned over to the 2.75 Inch Rocket Program Manager's Office.

B-157

TASK NUMBER: 06-F-73

TITLE: Immobilizer

AUTHORIZED FUNDING: \$18,727

TASK DURATION: 25 January 1973 to 12 December 1973

DESCRIPTION AND RESULTS: This task evaluated the Taser Systems, Inc., immobilizer weapon as an instantaneous incapacitation device for close-range applications. The device, consisting of electronics package and contactors with trailing wires, acts to dominate the neuromuscular system in the human body through the application of small electrical currents. In the majority of cases, the system did not produce immediate incapacitation of the highly motivated, trained test subjects.

B-158

TASK NUMBER: 07-F-73

TITLE: Modified Illumination Warhead, 2.75 Inch

AUTHORIZED FUNDING: \$7,543

TASK DURATION: 26 February 1973 to 31 August 1973

CONTRACTOR: Thiokol Chemical Corporation

DESCRIPTION AND RESULTS: This task was a follow-on to modify the warhead developed on Task 20-F-72.

TASK NUMBER: 02-F-74

TITLE: Shaped Charge, Antitank, Hand-Thrown

AUTHORIZED FUNDING: \$12,167

TASK DURATION: 12 July 1973

DESCRIPTION AND RESULTS: There is no hand-deployed device available to give the infantryman in urban warfare the capability to disable a tank which is buttoned up. Preliminary development of the device was being completed upon deactivation. It will be 2.5 inches diameter by 7 inches long and weigh approximately 1.5 pounds. It will be capable of penetrating 4 to 8 inches of armor plate. Existing munitions components will be used and adapted where possible.

The hand-thrown device will be oriented to impact as nearly perpendicular to the tank surface as possible or to be retained and orient itself after impact with the tank surface. Fuzing and orientation were expected to be the major technical problems.

TASK NUMBER: 30-F-74

TITLE: 90MM and 105MM Subcaliber Training Device (CATB)

AUTHORIZED FUNDING: \$62,000

TASK DURATION: 25 January 1974

DESCRIPTION AND RESULTS: A tank gun subcaliber device (caliber .50) is needed to train crews in all aspects of tank gunnery without the expense and area requirements needed to fire full caliber ammunition.

The 90mm and 105mm Subcaliber Training Devices are the same size and weight as standard rounds. They consist of a caliber .50 M8 spotting rifle barrel and a specially designed bolt and breech mechanism mounted inside the standard drill round (90mm M12B1) and a machined aluminum case for the 105mm round.

The subcaliber training devices simulate the standard rounds. They may be fired at stationary or moving targets at ranges of 500 to 1500 meters. The use of the ranging and fire control system trains the tank crews in accomplishing second round "Burst on Target." Compensation for the initial velocity difference (1795 fps versus 2400 fps) is accomplished by a special cam for the M13 Tank Gunfire Range Computer. The task was still open upon deactivation.

TASK NUMBER: 01-M-63

TITLE: Load Carrying Device, Man Propelled

AUTHORIZED FUNDING: \$116,306

TASK DURATION: 17 December 1962 to 19 January 1966

CONTRACTOR: Wilson Nuttall

DESCRIPTION AND RESULTS: Develop a manually propelled device with a payload capacity of 250 lbs, intended primarily for use by squad size units. Propelled by two men, it will be capable of being operated to varying degrees in terrain, such as marshes, rice paddies, mud of all consistencies, open water, sand, hilly country and narrow jungle trails. In those areas where use is not feasible, it will be possible to rapidly unload and disassemble into components that are man transportable. Possible loads would be crew served weapons, ammunition, rations, communication equipment, and, in an emergency, could be used for medical evacuation.

The Load-Carrying Device (developed at LWL) is a man-propelled, one-wheel "cart" of plastic construction. It weighs less than 80 pounds and has a rated payload of 250 pounds. Its over-all dimensions are: 81 inches long (exclusive of handles), 28 inches wide and 31 inches deep.

The device is propelled by two men. When fully loaded, it will float in 14 inches or more of water. For crossing deep water, the top and bottom halves of the device can be joined together to form a stable twin-hulled boat. In this configuration the handles are used to join the hulls together and as paddle handles. To carry a litter patient, a lightweight nylon cloth is provided. The cloth is mounted in two sections and is fastened together to form a litter.

The device was Service Tested by the U. S. Army Infantry Board and the U. S. Army Airborne Electronic and Special Warfare Board during the period June 1964 - April 1965 against the draft SDR. The results of the Service Test indicated that the item was suitable for military use, subject to the correction of deficiencies and as many of the short-comings as possible and recommended that the item be resubmitted for test. However, due to the lack of an approved SDR or operational requirement, the task was terminated.

TASK NUMBER: 02-M-63

TITLE: Lightweight Power Unit

AUTHORIZED FUNDING: \$54,772

TASK DURATION: 17 December 1962 to 13 September 1964

CONTRACTOR: Raytheon

DESCRIPTION AND RESULTS: This study was designed to develop a power unit weighing not more than ten lbs, that will deliver 200 watts @ 28 volts DC. It was to be a closed cycle, completely sealed system consisting of a boiler, steam engine, condenser and high speed permanent magnet generator. The unit was to operate with a fuel consumption of not more than two pounds per horse power hour. The task was terminated prior to completion.

B-163

TASK NUMBER: 04-M-63

TITLE: Personnel/Cargo Lowering System for Helicopters

AUTHORIZED FUNDING: \$98,079

TASK DURATION: 4 March 1963 to 6 April 1966

DESCRIPTION AND RESULTS: To develop a line descent system for lowering personnel and/or cargo (up to 500 lbs) from hovering helicopters to the ground. It will also be designed to lower a parachutist to the ground after a tree landing.

The Lowering System developed consists of a lowering governor device, 150 feet of 3/8" nylon lowering braid, carrying case, and a personnel harness. The personnel harness is required only for personnel lowering from helicopters. The device will lower 500 pounds of cargo and personnel from a hovering helicopter and can be used by a parachutist to safely lower himself to the ground after a tree landing. An interim webbing floor attachment loop is available for the UH-1 aircraft, and attachment can be made to floor tie-down fittings of the CH-47A aircraft. The system weighs 7 lbs. 13 oz. complete or 6 lbs. 5 oz. without the personnel harness. Overhead attachment points are being developed under separate tasks, in order to provide for faster and safer deployment of troops.

Fifty units were sent to Vietnam in January 1965 for evaluation. ACSFOR received requests from U. S. Forces in Vietnam for 640 units, and NLABS were assigned procurement action. Eight units were sent to Thailand for evaluation in January 1966. The item was type classified STD A.

TASK NUMBER: 06-M-53

TITLE: Device to Rapidly Refuel Helicopter from 55 Gal Drums

AUTHORIZED FUNDING: \$32,518

TASK DURATION: 23 October 1963 to 17 March 1965

DESCRIPTION AND RESULTS: Develop a small lightweight fuel transfer system to provide a remote area capability of rapidly refueling helicopters and army aircraft from 55-gallon drums. Two refueling systems were developed by LWL. One system weighs 68 pounds (a 25-gallon-per-minute system) and the other weighs 170 pounds (the 50 GPM system). Both systems utilize standard fittings and modified commercial components.

After the evaluation of preliminary models, two systems were fabricated and tested by joint effort between USALWL and USATECOM. During Safety Certification Tests by USATECOM, approximately 1400 drums of fuel (55-gallon each) were pumped with the 25 GPM system and 3000 drums with the 50 GPM system.

Upon completion of the Safety Certification Tests, six 25 GPM systems and four 50 GPM systems were fabricated and shipped to ACTIV in January 1964 for field evaluation. These first ten systems, which used a "go no-go" type fuel filter as a major component of the system, were not adequate due to the high level of fuel contamination existing in Vietnam. Consequently, ten new systems containing a filter/separator unit and other desirable features were fabricated and shipped to Vietnam in August 1964. As a result of field utilization of these ten systems in Vietnam and upon evaluation of the systems by ACTIV and U. S. Army Support Command, forty additional 25 GPM systems were procured by U. S. Army Support Command in Vietnam. In addition, the 11th Air Assault Division, recommendation of LWL, evaluated the fueling systems as originally fabricated by LWL, and purchased 145 units for operational use. The 11th Air Assault Division retained the "go no-go" type filter which proved satisfactory for their operating conditions.

B-165

TASK NUMBER: 01-M-64

TITLE: Towed Glider, Mobile Aircraft Refueling System

AUTHORIZED FUNDING: \$4,268

TASK DURATION: 23 October 1963 to 17 March 1965

DESCRIPTION AND RESULTS: To furnish the pumping and fuel transfer system for a Towed Glider, Mobile Aircraft Refueling System being developed by the U. S. Army Transportation-Engineering Command (USATRECOM), under Advanced Research Projects Agency (ARPA) contract.

The scope of this project was coordinated with USATRECOM. The work accomplished by them on the rogallo wing was monitored and LWL's work on the refueling system kept pace with the development and testing program of the rogallo wing.

B-166

TASK NUMBER: 02-M-64

TITLE: Flotation Gear for Army Aircraft

AUTHORIZED FUNDING: \$918

TASK DURATION: 17 March 1964 to 26 August 1965

DESCRIPTION AND RESULTS: Design, develop and fabricate unsinkable flotation landing gear for Army aircraft used in support of Special Warfare activities in remote areas of the world. Initial phase will consist of a feasibility study to include preliminary design, types of materiel, quantity and weights estimates, and description of manufacturing process.

A feasibility study was completed and forwarded to CDC. It was shown that non-sinkable pontoons and floats can be made with a slight weight reduction, a substantial reduction in maintenance and a slight reduction in cost.

B-167

TASK NUMBER: 03-M-64

TITLE: Rolling Ammunition Carrier

AUTHORIZED FUNDING: \$19,317

TASK DURATION: 17 March 1964 to 17 March 1965

DESCRIPTION AND RESULTS: Design and develop a device to enable one to three men to move 6 rounds of 105 MM Howitzer ammunition (total weight 295 lbs.) short distances of 100 yards to 1/2 mile over rough terrain. Empty weight is to be approximately 35 lbs. Work on this task was performed in response to a specific request from the 11th Air Assault Division, Fort Benning, Georgia. Ten rolling ammunition carriers were fabricated and delivered to the 11th Air Assault Division.

B-168

TASK NUMBER: 04-M-64

TITLE: Vehicle Design for Unconventional Warfare

AUTHORIZED FUNDING: \$11,945

TASK DURATION: 14 May 1964 to 17 March 1965

DESCRIPTION AND RESULTS: Investigate various designs for structures and components of vehicles for unconventional warfare and analyze information on materials which may be applied to vehicle design, thus permitting quick solutions to mobility problems. A lightweight structure having a very high impact resistance was developed and was applied to the "Man-Propelled Load-Carrying Device" (LWL Task 01-M-63).

B-169

TASK NUMBER: 05-M-64

TITLE: Feasibility Investigation of Swamp Boat

AUTHORIZED FUNDING: \$80,377

TASK DURATION: 16 June 1964 to 6 July 1966

DESCRIPTION AND RESULTS: Determine feasibility and establish engineering requirements for development of a swamp boat for use in remote area conflict.

The testbed vehicle had a modified five-point hull - 18 feet long, a beam of 6 feet, and a draft of 6 inches. The engine was the T-63 gas turbine (LOH engine), which drives a 5 foot diameter 8-bladed propeller in a ducted fan, and develops 1300 lbs. of static thrust for the 2000 pound vehicle weight. Steering was accomplished with combination air and mud rudders. Maneuverability, and stop and start performance were demonstrated on mud, dry turf, and dry marsh. Water speed was 30 mph. Steering control was responsive on both water and mud or grass, at both high and low speeds, with very little skidding on sharp turns.

A draft SDR and preliminary design specifications for a 5-man reconnaissance version of the testbed vehicle were prepared. The fully loaded and equipped tactical vehicle would develop the same performance as the testbed, permitting it to be fully mobile in the Plain of Reeds and rice paddy areas.

B-170

TASK NUMBER: 06-M-64

TITLE: Parachutists' Descent Device

AUTHORIZED FUNDING: \$12,391

TASK DURATION: 10 July 1964 to 9 September 1965

DESCRIPTION AND RESULTS: Develop a device for use by parachutists to lower themselves from trees. Gross loads up to 300 pounds are anticipated. LWL developed and fabricated a system weighing 3.4 pounds which is similar to but smaller than the Cargo-Personnel Lowering System (Task 04-M-63).

Eight systems were delivered to USATECOM for Engineering Design and Safety Tests in December 1964. The test report was received in May 1965. Five additional units were sent in May 1965 to ARPA-VN for evaluation. The project was terminated because of lack of a requirement.

TASK NUMBER: 01-M-65

TITLE: Man Assisted Powered Transporter

AUTHORIZED FUNDING: \$60,165

TASK DURATION: 3 August 1964 to 21 March 1966

CONTRACTOR: Stevens Institute of Technology

DESCRIPTION AND RESULTS: The purpose of this task was to (a) develop the concept for a suitable, man-assisted, powered load carrying device; (b) design and fabricate a testbed of the concept, and perform feasibility tests on the testbed to determine mobility of the configuration, general operating characteristics, and modifications required; (c) develop a "quieted" internal combustion engine or a low-noise-level engine of unique design, and (d) procure two prototype transporters for Service Test.

The man-assisted powered transporter was to have a 500-pound payload capacity. It was intended for use primarily by a military-squad size unit of dismounted troops committed to counterinsurgency and limited warfare operations in underdeveloped areas of the world, specifically, in areas inaccessible to conventional vehicles.

Beginning in January 1965, a background engineering investigation, including concept development and preliminary design, was conducted in-house by LWL. The feasibility testbed model was completed in late April 1965. With one or two man dismounted operation, the transporter was considered capable of operation over narrow jungle trails, rain forests, rough mountain trails with up to 45% grade and 30% side slope, savannah, swamps, marshland, rice paddies, and delta lowlands.

The feasibility testbed was test operated over various types of difficult terrain. Inherent in the single track narrow vehicle design, the device had to be man-assisted to maintain stability over unlevel terrain. Consequently, the testbed was found to be undesirably hard to manhandle by the operator over such difficult terrain.

TASK NUMBER: 02-M-65

TITLE: Mobility Augmentation of M113 APC

AUTHORIZED FUNDING: \$22,844

TASK DURATION: 3 August 1964 to 6 April 1966

DESCRIPTION AND RESULTS: The Mobility Augmentation System for the M-113 is a refinement and improvement of an existing field expedient now in use in South Vietnam. The original Capstan-Anchor Vehicle Recovery System, essentially a self-recovery winching arrangement is a very effective system but requires 40 to 75 minutes to effect a crossing. Tests conducted at Aberdeen Proving Ground as part of this task indicate that the canal crossing time can be reduced 80 to 90 percent by substituting one or more Danforth White Marine Anchors (Mobility Augmentation System) for the deadman and earth auger originally used.

The LWL system consists of two 300 foot lengths of one inch nylon rope, two capstans with mounting hardware and a Danforth type anchor. When used in the vehicle assist role, the anchor is capable of providing 15,000 lbs. of holding force. Two men, with minimum training, can emplace the anchor and activate the systems in less than five minutes. In February 1966, 111 systems were sent to Vietnam for operational evaluation.

TASK NUMBER: 03-M-65

TITLE: Site Marker Balloon

AUTHORIZED FUNDING: \$40,799

TASK DURATION: 21 December 1964 to 4 October 1966

CONTRACTOR: Goodyear Aerospace Corporation

DESCRIPTION AND RESULTS: The Site Marker Balloon is a signalling device to aid in close air support, resupply and target marking for troops engaged in operations under a dense jungle canopy. The balloon is aerodynamically configured to fly almost vertically over the tether point in a 30 knot wind and will contain approximately 6 to 8 cubic feet of gas. The system consists of a balloon, tether line and a dry chemical gas producing component.

An aerodynamically configured balloon was developed and successfully tested, but estimated production costs were high. A dry hydrogen generating system was developed which produced 8 cubic feet of gas for a weight of 2-1/4 lbs., but it did not meet the 155°F storage requirement. Project was terminated in favor of the Elevated Site Marker Balloon, a less expensive and more immediately available system [Task 02-M-66].

TASK NUMBFR: 04-M-65

TITLE: Lift Boost System for UH-1-B Helicopters

AUTHORIZED FUNDING: \$205,148

TASK DURATION: 12 April 1965 to 5 July 1968

CONTRACTOR: Dynasciences Corporation

DESCRIPTION AND RESULTS: The item is a demonstration model helicopter lift boost system to be mounted externally on the UH-1B helicopter structure. Its purpose is to alleviate the loss of lift suffered by the helicopter due to extreme environmental conditions, i.e., operations out of small clearings that require vertical ascent, extremely high temperatures, absence of wind, etc. The system consists, basically, of two-ducted propellers mounted one on each side of the helicopter structure. The two propellers are powered by a single gas turbine engine; the T-63 power plant currently in use on observation-type helicopters. The concept includes a saddle-type truss structure which serves as a mount for the two ducted propellers, the one engine, a fuel tank, and an oil tank. The saddle structure is bolted to the existing ordnance attachment points of the UH-1 series helicopters. An engine and system control for the detachable system is mounted in the helicopter cockpit. The testbed demonstration model system as fabricated and ground tested will increase the helicopter's take-off payload by approximately 500 pounds.

The demonstration model system was ground tested, but flight tests were postponed due to problems of safety certification. Safety Certification action was postponed pending a more firm statement of requirement from the potential users and the task was terminated due to lack of a requirement.

TASK NUMBER: 01-M-66

TITLE: Overhead Anchoring System for Personnel Rappelling and Parachuting
From Helicopters

AUTHORIZED FUNDING: \$39,117

TASK DURATION: 9 August 1965 to 16 June 1967

DESCRIPTION AND RESULTS: The anchoring system consists of an extensible structural member fastened to the aft wall of the helicopter cabin. The extended beam allows the rappellers to clear the landing strut as they leave the aircraft. When the extensible members are retracted, the cabin doors may be closed. The anchoring system will permit three rappellers to be deployed in rapid sequence from each side of the aircraft. The system will be a field installed kit, which may be quickly installed or removed. Engineering and Service Tests were completed, and two items made available for evaluation in Vietnam. AMC-AVCOM was the designated parent agency. Test Board decided that there was no requirement for this item.

TASK NUMBER: 02-M-66

TITLE: Elevated Site Marker

AUTHORIZED FUNDING: \$66,423

TASK DURATION: 13 October 1965 to 13 February 1967

DESCRIPTION AND RESULTS: The Evaluated Site Marker Balloon is used by an individual or units to mark a ground location in areas of high vegetation density. The marker is observable from aircraft flying at altitudes up to 2,000 feet at a slant range of one mile. A night capability is also provided. The marker will be used to mark forward limits of friendly forces and to provide a reference point for aerial resupply and target marking.

Two hundred and twelve systems were sent to Vietnam for evaluation in Jun 66. However, 200 systems were lost in shipment and only 12 were available for evaluation. Since sufficient systems were not available for evaluation, an ENSURE Request has been received for 200 additional systems which are being fabricated and will be shipped to Vietnam in first quarter FY68 (Task 10-M-67).

B-177

TASK NUMBER: 03-M-66

TITLE: Overhead Personnel/Cargo Rappelling Attachment for CH-47

AUTHORIZED FUNDING: \$43,908

TASK DURATION: 8 December 1965 to 4 November 1968

CONTRACTOR: Boeing Company

DESCRIPTION AND RESULTS: The Overhead Attachment Kit was designed to permit rapid and safe rappelling of a full troop load from the ramp and hatch areas of the helicopter. Overhead attachments were provided for simultaneous exit of personnel from both sides of the aft ramp, and from the rescue hatch. Three attachment kits were designed and built. Engineering and Service Tests were completed and two units made available for evaluation in Vietnam. AMC-AVCOM is the designated parent agency.

B-178

TASK NUMBER: 04-M-66

TITLE: Dustproofing

AUTHORIZED FUNDING: \$29,778

TASK DURATION: 21 January 1966 to 28 July 1966

DESCRIPTION AND RESULTS: USALWL's approach to the problem included dustproofing shoulder and overrun areas subjected to fixed wing prop wash and helicopter rotor downwash in non-traffic base areas; for dustproofing helicopter staging areas; and for keeping down the dust anywhere near a location at which troops are quartered or at which helicopters operate, even infrequently. Three techniques were evaluated: Prefabricated plastic membranes; spray-on latex emulsion; and indigenous materials in Vietnam.

Engineering design tests were conducted to develop suitable methods of dustproofing helicopter staging areas and overrun non-traffic areas. Various prefabricated membrane fabrics and tie-down techniques, various indigenous materials and application techniques, and a latex emulsion spray-on film and spraying techniques were evaluated. Inasmuch as other agencies had taken over this requirement the task was terminated.

TASK NUMBER: 05-M-66

TITLE: Resojet Man-Pack Tunnel Flusher

AUTHORIZED FUNDING: \$28,139

TASK DURATION: 1 March 1966 to 19 December 1966

DESCRIPTION AND RESULTS: The Resojet is a valveless pulse jet, with ring air-foil augmentors. The engine is a U-shaped pipe. Exploding exhaust gases from both ends of the tube intermittently ram air through the augmentors. Smoke or chemical agents can be introduced into the tunnel to flush occupants or to identify alternate exits. The carbon monoxide content of the discharged product is non-lethal; however, the heat build-up in the tunnel may produce intolerable temperatures. The flusher consists of two units, blower back-pack, weighing 38 lbs.; and a 5 gallon fuel pack weighing 50 pounds when full.

Pre-prototype tests and demonstrations were completed and two units were evaluated in Vietnam. However, a surplus auxiliary power unit gas turbine was selected to meet the immediate operational requirement, so that no operational request for the Resojet was received.

TASK NUMBER: 06-M-66

TITLE: Walking Wheel Concept

AUTHORIZED FUNDING: \$92,602

TASK DURATION: 26 April 1966 to 13 March 1969

CONTRACTOR: Lockheed Aircraft Services Company, Division of Lockheed Aircraft Corporation

DESCRIPTION AND RESULTS: This is an experimental vehicle which permits operation in off-road soft soil conditions. In addition, the vehicle operates on improved surfaces at speeds and efficiencies equal to conventional wheeled vehicles. The running gear consists of four major-minor wheel assemblies. Each assembly consists of three minor-wheels radially mounted on a spider about the major-wheel axle. On firm ground, the minor-wheels are driven, and each wheel on the ground functions as a tandem-wheel bogie. In water or on very soft ground, the major-wheels are driven, and "walk" in a paddle-wheel fashion. The wheel assemblies provide inherent swimming capability.

An experimental vehicle was built and tested with 16 inch and 20 inch diameter Terra-tires. Trafficability tests in mud established a one-pass Vehicle Cone Index of 8 (one-pass VCI for the M116 tracked cargo vehicle is 7). Twenty inch diameter tires were fitted to the vehicle, and further mobility tests showed a one-pass VCI of 5. The vehicle can negotiate 22-inch vertical step heights. A recommendation was made to DA that this vehicle be considered for further development to satisfy requirements for high mobility vehicle.

TASK NUMBER: 01-M-67

TITLE: Use of Lowering Device With CH-34

AUTHORIZED FUNDING: \$4,471

TASK DURATION: 1 July 1966 to 22 December 1966

DESCRIPTION AND RESULTS: An aircraft step kit is provided which may be installed in the field. The step assists rappellers to make their exit from the aircraft. Four webbing assemblies are provided which fasten to floor tie-down fittings by means of snaps. Rappellers attach to floating D-rings on the webbing assemblies.

Integrated Engineering/Service Tests were completed, and a quantity of kits delivered to VN by NLABS. Procedures were incorporated into the manual for the lowering device.

TASK NUMBER: 02-M-67

TITLE: All Terrain Portable Heliport

AUTHORIZED FUNDING: \$119,153

TASK DURATION: 25 July 1966 to 30 April 1968

DESCRIPTION AND RESULTS: A study was conducted to develop a lightweight All-Terrain Portable Heliport which can be transported by one helicopter and emplaced by lowering of the unit onto the jungle canopy.

The unit consists of a 20 ft. diameter rigid platform with six pivoted legs which are approximately 20 ft. long. At the end of these legs a spider web type of wire rope net is attached and at the center of the platform a structural tube extends down 7 ft. to allow the net to be attached at the center. The net is designed to billow up on top of the foliage and obtain support for the rigid platform which is above the net.

TASK NUMBER: 03-M-67

TITLE: Canal Bridge, Troop and Small Vehicle

AUTHORIZED FUNDING: \$190,797

TASK DURATION: 27 July 1967 to 20 May 1968

DESCRIPTION AND RESULTS: The bridge is an assembly of modular, 11 feet long by 7 feet wide rapidly connected, flexible blankets which can be quickly deployed across streams up to 100 feet wide. The assembly is held in place across the stream by aluminum stakes pushed into the stream banks. It is capable of sustaining a single file column of troops who are two paces (five feet) apart and running, walking or standing still. Each modular unit consists of a 1/4 inch thick closed cell polyethylene flexible foam layer, laminated between two sheets of nylon scrim, reinforced polyethylene film. The unit is stiffened crosswise by 7/8 inch diameter by 30 inch long polycarbonate tubes attached crosswise the blanket at 30 inch intervals. Each bridge unit weighs approx. 30 pounds; is equipped with back-pack carrying straps, and is air-droppable from helicopters hovering at 75 feet or less.

Three hundred and thirty foot bridge units were delivered to Vietnam for troop evaluation on 20 Mar 68. The Mobility Equipment Command (the designated parent agency) will fulfill any future validated requests for this item.

TASK NUMBER: 05-M-67

TITLE: Materials Handling Augmentor for Standard Truck Tractors

AUTHORIZED FUNDING: \$114,142

TASK DURATION: 7 September 1966 to 20 January 1969

DESCRIPTION AND RESULTS: The fork-lift attachment mounts on the frame of the M-52 tractor and folds down flush with the tractor frame. The unit is supplied in kit form for field installation on M-52 Truck-Tractors. The attachment enables the driver to unload his semi-trailer without assistance or delay. The unit is hydraulically operated and is powered from the M-52 power take-off. The payload is 4000 pounds.

Engineer Design Tests were conducted on one unit. Improvements were made and six units shipped to RVN for evaluation. They were found to be unsuited for use in RVN, and the ENSURE was cancelled.

Rejection of the item was attributed primarily to cracks in the frame of the M52-A tractor claimed to be caused or aggravated by the Material Handling Augmentor. The M52-A tractor has a history of similar frame cracking problems.

TASK NUMBER: 06-M-67

TITLE: Personnel Extraction and Pickup System for UH-1 Helicopter

AUTHORIZED FUNDING: \$14,431

TASK DURATION: 15 September 1966 to 2 June 1967

CONTRACTOR: All American Engineering Company

DESCRIPTION AND RESULTS: The Personnel and Cargo Pickup and Delivery (PACPAD) System Concept was developed from a technique in which basic lifting power of the helicopter rotor is harnessed to provide capability of hoisting loads from the ground to the hovering helicopter. It was intended for use with any helicopter, but for initial application to the UH-1B and UH-1D helicopters. The PACPAD System was a simple lightweight system consisting essentially of a hand controllable windlass sheave installed in the helicopter doorway, approximately 400 feet of rope, a ground anchoring means on one end of the rope, and a multiple personnel/cargo sling on the other end of the rope.

Due to density and altitude conditions and gross weight of UH-1's used in VN, it was determined that in many instances, hovering out of ground effect with the aircraft would be hazardous. As a result of the limitations that these conditions would put on this system, it was decided to terminate the program at the conclusion of the preliminary design stage.

TASK NUMBER: 07-M-67

TITLE: Waterjet Augmentation Kit for M113, Feasibility

AUTHORIZED FUNDING: \$74,170

TASK DURATION: 16 March 1967 to 8 October 1969

CONTRACTOR: Aerojet General Corporation

DESCRIPTION AND RESULTS: The waterjet kit is designed for field retrofit on existing vehicles. Two, 15 inch diameter waterjet pumps are installed one on each side of the aft ramp. The pumps are driven by a special power train from the vehicle transfer-case power take-off. The waterjet pumps are high-flow-rate, low-head, axial-flow units designed specifically for maximum thrust on low-speed swimmer vehicles. Maneuvering diverter valves divert the flow for reverse thrust and for steering. The swimming speed is increased to 6 mph, and the vehicle can pivot-steer in the water. The increased swimming speed requires a larger planing board. Field installation of the complete kit is estimated to require 30 manhours. The complete kit weight is 600 pounds.

One kit was installed and tested on an M113. This kit was modified, refurbished, installed and tested on an M113A1 vehicle. USARV cancelled their request for evaluation of the kit; thereupon, the kit was transferred to USATACOM for use in research programs. The U. S. Army Tank-Automotive Command was the designated parent agency for this project.

B-187

TASK NUMBER: 08-M-67

TITLE: Feasibility Investigation of Delta Weapon Platform

AUTHORIZED FUNDING: \$13,394

TASK DURATION: 20 March 1967 to 18 December 1967

DESCRIPTION AND RESULTS: Artillery operations in swamp or inundated areas such as the Mekong Delta of RVN are presently limited to the few existing firm ground areas. The feasibility of providing an airmobile, stable platform from which 105mm howitzers may be accurately fired in such areas was investigated and determined. A number of concepts were investigated, several of which are feasible.

The study concluded that it is entirely feasible to produce an air-transportable (external CH-47 load) platform to support a 105MM - M-102 Howitzer for delta operations. The configuration considered most suitable was a floating platform anchored in place by eight 40 pound anchors spaced equally around the platform. Stability is enhanced by tensioning the anchor lines.

B-188

TASK NUMBER: 09-M-67

TITLE: Helicopter Floats-Quick Adaption

AUTHORIZED FUNDING: \$40,982

TASK DURATION: 22 March 1967 to 25 January 1968

CONTRACTOR: Dynasciences Corporation

DESCRIPTION AND RESULTS: The objective of this task was to provide the UH-1B/D helicopters with the capability of operating in and from water areas with its own floatation gear. The item developed consisted of a float kit (2 floats) for the UH-1B and D helicopters which could be readily attached to the helicopter with the load hook, through the existing skids. Attachment time was less than five minutes, detachment instantaneous. The floats were sized to provide adequate buoyancy and stability up to gross weights of 9500 pounds. They were compartmented to insure that sufficient buoyancy and stability could be maintained with up to seven compartments damaged. The program was cancelled in Jan 68 due to non-validation of formal requirement.

B-189

TASK NUMBER: 10-M-67

TITLE: Elevated Site Marker (ENSURE)

AUTHORIZED FUNDING: \$35,614

TASK DURATION: 17 May 1967 to 25 June 1968

DESCRIPTION AND RESULTS: The Site Marker Balloon is used by individuals or units to mark a ground location in areas of high vegetation density. The marker is observable from aircraft flying at altitudes up to 2,000 feet at a slant range of one mile. A night capability is also provided. The marker will be used to mark forward limits of friendly forces and to provide a reference point for aerial resupply and target marking.

Two hundred systems were sent to Vietnam for evaluation in Mar 68. U. S. Army Natick Laboratories was the designated parent agency for this task to follow through on any future requests.

B-190

TASK NUMBER: 11-M-67

TITLE: Tank Traction Assist/Traction Augmentor for M-48 Tank

AUTHORIZED FUNDING: \$47,364

TASK DURATION: 22 May 1967 to 21 January 1969

CONTRACTOR: Defense Operation Division of Chrysler Corporation

DESCRIPTION AND RESULTS: The item is a set of cable loop assemblies for application to the T97E2 tracks on the M-48 and M-60 tanks. A vehicle set includes 80 cable loop assemblies (3/4" steel wire rope) and 160 new wedge bolts. Forty cable loop assemblies are applied to the outboard side of each track. The cable loop assembly is held to the track link wedge by a new wedge bolt, the same as the existing wedge bolt except 1/2 inch longer. The cable loops extend each track width approximately 10 inches. The track width extender assemblies are intended to improve mobility of the tank vehicle when operating over the soft wet terrain such as the Delta areas of Vietnam.

The item is to be considered expendable, each tank's mission operation to expend 1 to 20 cable loop assemblies - depending upon severity of the terrain. A broken assembly does not require immediate replacement; it can be replaced as time permits.

The vehicle sets were sent to RVN in October 1968 for test and evaluation. Results of the field Vietnam evaluation indicated that the added maintenance required to replace broken cable assemblies is not tolerable during tactical operations.

TASK NUMBER: 01-M-68

TITLE: Aerial Pick-up System

AUTHORIZED FUNDING: \$5,499

TASK DURATION: 7 July 1967 to 29 May 1968

CONTRACTOR: All American Engineering Company

DESCRIPTION AND RESULTS: A study was conducted of the characteristics of an aerial pickup system designed to meet a specific requirement. The requirement was to pick up objects with a fixed-wing aircraft under the following conditions:

- a. Objects to be picked up, 1 to 50 pounds in weight, 1/2 to 4 cubic feet in volume.
- b. Recovery clearing 200 feet in diameter bordered by 100 feet trees.
- c. Pick-up speeds up to 215 knots.
- d. Station to be erected by 2 to 3 men in 20 to 30 minutes.
- e. Ground station weight not to exceed 50 pounds.

The study results indicated that the system best suited for the job is a two-balloon station similar to the letter pickup station, but sized to meet the 50 pound, 4 cubic foot, 215 knot criteria. All objectives of the specifications can be met with the exception of system weight (110 lbs compared to the 50 lbs desired).

B-192

TASK NUMBER: 04-M-68

TITLE: Delta Manual Load Carrier

AUTHORIZED FUNDING: \$7,949

TASK DURATION: 11 August 1967 to 25 July 1968

DESCRIPTION AND RESULTS: The Load Carrier is a boat-shaped skid which is approximately 2 feet wide by 4-1/2 feet long by 5 inches deep. A rubberized fabric cover with waterproof zipper covers the top of the fiberglass body. The unit weighs 15 pounds. The unit was designed for use in transporting loads up to 100 pounds in water and marsh areas.

TASK NUMBER: 05-M-68

TITLE: Grain Pulverization Under Field Conditions

AUTHORIZED FUNDING: \$455,750

TASK DURATION: 29 August 1967 to 20 January 1969

CONTRACTOR: The Garrett Corporation

DESCRIPTION AND RESULTS: The Grain Pulverization System will rapidly grind and dispense large stores of rice. The system consists of a turbine-driven compressor and grinder. The compressor provides air for pneumatic pick-up to the grinder, and for dispersal. When destruction is not required, an alternate mode of operation permits transport, without grinding, to available containers for evacuation. The system weight is 600 pounds and grinding capacity is 15 tons per hours.

The requirement was cancelled by USARV. The development was terminated prior to final assembly and test of the scheduled five units.

TASK NUMBER: 06-M-68

TITLE: Sandbagging System

AUTHORIZED FUNDING: \$409,100

TASK DURATION: 7 September 1967 to 10 February 1970

CONTRACTOR: Dynasciences Corporation

DESCRIPTION AND RESULTS: A commercial lightweight ditch-digger has been combined with a conveyor and soil distribution system to provide a soil attainment and delivery capability sufficient to fill 500 or more standard sandbags an hour. A semi-automated means of tying-off the bags is incorporated into the machine. The system weight is less than 1500 pounds with the unit capable of being broken down into two components: the heavier of which weighs 900 pounds. The unit is self-propelled and fits within an envelope which allows transport by CH-47 helicopter (internal load), a standard 2-1/2 ton truck, or sling-loading (in two components) by UH-1 helicopter. Eight experimental units were fabricated for shipment to Vietnam.

B-195

TASK NUMBER: 07-M-68

TITLE: Medium Weight Sandbagging Machine

AUTHORIZED FUNDING: \$65,141

TASK DURATION: 2 January 1968 to 25 July 1968

DESCRIPTION AND RESULTS: The "Parsons #77L Trenchliner" commercial trencher was equipped with a sandbag holding system to allow filling sandbags from the normal outflow of dirt. Up to 500 filled, but not tied, sandbags can be produced per hour operating with a crew of from 3 to 4 men.

Four machines were put in use in Vietnam. The designated parent agency for this task was the Mobility Equipment Command.

TASK NUMBER: 08-M-68

TITLE: Fortification Destruction and Canal Barrier Clearing, Feasibility and
VN Tests

AUTHORIZED FUNDING: \$98,602

TASK DURATION: 29 March 1968 to 10 February 1970

DESCRIPTION AND RESULTS: The system is essentially a hydraulic mining device consisting of two hydraulic monitors (2000 gpm output) fed by two pump-and-diesel-engine combinations. The system is configured as a "Lift-on - Lift-off" kit for an LCM-6 and requires modification to the craft.

Tests revealed that the monitors can remove from 2 to 10 cubic yards of soil per minute. Effective ranges at this production are approximately 150 feet. The Fortification Destruction and Canal Barrier Clearing System was designed with considerable flexibility particularly in the piping system. The pumps may be operated in series or parallel supplying one or both monitors. It was found that this degree of flexibility was not required, while it added significantly to the weight. The kit was evaluated at Aberdeen Proving Ground, Maryland, and the information gained was used in the development of the equipment sent to Vietnam which is described in Task 06-M-69 of this report.

B-197

TASK NUMBER: 09-M-68

TITLE: Procurement of Ripper Attachment for D-7E Caterpillar Tractor

AUTHORIZED FUNDING: \$4,820

TASK DURATION: 3 April 1968 to 10 May 1968

DESCRIPTION AND RESULTS: The item is a Caterpillar Tractor Company No. 8 Ripper Beam Assembly with a 72 inch penetration tooth (as normally used on a Caterpillar D-8 Tractor's ripper attachment) plus an adapter plate for applying the 72 inch penetration tooth to the D-7E Caterpillar Tractor.

Purpose of applying the 72 inch penetration tooth to the D-7E Tractor was to locate enemy emplaced tunnels. This was to be done by pulling the ripper tooth through the ground at a 72 inch depth. When a tunnel was intersected, the operator would feel a sudden relief on the tractor drawbar. If the ground was unusually hard or slippery, one or more pusher tractors could be used. The item was procured and turned over to MERDC, Fort Belvoir for test.

TASK NUMBER: 10-M-68

TITLE: Sandbagging Attachments

AUTHORIZED FUNDING: \$585

TASK DURATION: 17 April 1968 to 24 October 1968

DESCRIPTION AND RESULTS: The intent of the task was to determine the feasibility, or practicability of installing a simple manually actuated bag-holding device on a standard Army intrenching machine. The device would have been similar to the bag holder developed for use on the Medium Weight Sandbagger. It would have allowed a single operator to catch a portion of the normal dirt outflow in sandbags, without standing in the direct flow of dirt.

While it was considered feasible to attach such a device, experience with the Medium Weight Sandbagger indicated that it would not be of practical use in the field. Therefore, the task was terminated.

TASK NUMBER: 11-M-68

TITLE: Sandbag Stapler - Hydraulic

AUTHORIZED FUNDING: \$5,684

TASK DURATION: 19 April 1968 to 20 January 1969

DESCRIPTION AND RESULTS: The device consists of a hydraulically actuated stapler designed to close a filled sandbag with a single staple. It utilizes a commercially available box staple and any available source of hydraulic power (1000 psi).

The conceptual design of the test unit served as the basis for the design criteria used in the bag-closing hardware incorporated into Task-06-M-68.

B-200

TASK NUMBER: 13-M-68

TITLE: Intermittent Detonation Marine Propulsor

AUTHORIZED FUNDING: \$9,452

TASK DURATION: 27 June 1968 to 3 October 1969

DESCRIPTION AND RESULTS: The item is a proprietary propulsion device intended to be quiet running and weed-free. It consists primarily of a combustion chamber and a tubular duct. Fuel and air are supplied to the combustion chamber, where it is ignited to produce a detonation. The shock wave is focused and reinforced so as to expel a slug of water out of the tubular duct, producing a forward thrust. There are no moving parts. Each detonation is triggered by a spark.

Initial feasibility testing was completed. While there was some indication that the device had the potential of becoming an operational unit, it was still in the early stages of R&D. The inventor had sold rights to a private concern, which intended to develop the device as an outboard motor.

B-201

TASK NUMBER: 01-M-69

TITLE: Sandbag Bunker Kit

AUTHORIZED FUNDING: \$43,532

TASK DURATION: 24 July 1968 to 30 September 1970

DESCRIPTION AND RESULTS: The bunker is made from corrugated aluminum sheet bent to form a half cylinder. The material is available commercially as culvert sections. Each section is four feet long by eight feet wide by three and one-half feet high and weighs only 58 pounds. While the sections may be overlapped to form bunkers of any length, the kit consists of two sections which form a bunker eight feet by eight feet by three and one-half feet high. Reinforced plastic covers are provided to keep the bunker and its sandbag cover dry. The bunker, covered by 18 inches of sandbags, will protect occupants from a direct hit by an 81mm mortar round.

Static testing of 81 and 82mm mortar rounds exploded at various locations on the bunker and against both wet and dry sandbags filled with sand, earth, or clay was completed. Thirty kits were sent to Vietnam for evaluation.

TASK NUMBER: 02-M-69

TITLE: Helicopter Payload Capability Meter

AUTHORIZED FUNDING: \$19,186

TASK DURATION: 16 August 1968 to 12 October 1970

DESCRIPTION AND RESULTS: The Helicopter Payload Capability (Go-No-Go Take-Off/Landing Calculator) Meter is a mechanization of the UH-1H helicopter performance and engine power data as a function of outside air temperature (OAT). It is a mechanical calculating device and requires no power or other connection for its operation. The unit is 2 x 2 x 4 in. in size, with two 3/8 x 4 in. long mounting flanges. The device defines operational limits of the helicopter for predetermined flight modes in terms of the turbine gas producer speed N_1 as a function of OAT. The pilot is provided with a visual display of the nominal usable power N_1 , at the existing gross weight and ambient condition.

USATECOM Aviation Test Board Military Potential Test Report, dated Jul 70 found the device to have military potential and recommended further development. Four additional units, slightly modified, were sent to USARV for evaluation. While the device functioned satisfactorily, it was not considered sufficiently useful for Army-wide use.

TASK NUMBER: 03-M-69

TITLE: On Site Evaluation of Helicopter LZ Clearing Equipment and Techniques

AUTHORIZED FUNDING: \$12,583

TASK DURATION: 3 September 1968 to 10 February 1969

DESCRIPTION AND RESULTS: USALWL was requested by the Air Force Weapons Laboratory to participate in the SEA evaluation of the Helicopter Landing Construction Device - "Combat Trap" - an M-121 10,000 pound bomb deployed from the CH-54 and C-130 for clearing trees from proposed helicopter landing zones. An on-site USALWL team of two evaluated the engineer follow-up effort required after the blast to enlarge the blast affected area to a useable multiple HLZ by use of conventional chain saw equipment.

It was found that chain saws were adequate to quickly enlarge blast sites or to construct HLZ's in tropical jungle, provided proper accessory items were available for saw sharpening, maintenance, and provided the troops had received some training. Results of USALWL evaluation were provided for AFWL Report of SEA Combat Trap evaluation. Also, a letter report of requirements to improve Engineer training and equipment was provided to US Army agencies which have related training or procurement responsibility.

B-204

TASK NUMBER: 04-M-69

TITLE: Platform, Air-Transportable

AUTHORIZED FUNDING: \$6,577

TASK DURATION: 17 September 1968 to 21 January 1969

DESCRIPTION AND RESULTS: The unit consists of a 20 foot diameter rigid platform with six pivoted legs which are approximately 20 feet long. At the end of these legs, a spider web type of wire rope net is attached. The net is designed to billow up on top of the foliage and obtain support for the rigid platform which is above the net. The platform was designed for operation with UH-1 Helicopters. It weighs 1000 pounds including sling, power supply and electric personnel hoist. The base of the unit is 60 feet in diameter and the platform is 7 feet above the base when placed on level ground. One platform and spare parts were shipped to RVN in October 1968 for test and evaluation.

B-205

TASK NUMBER: 05-M-69

TITLE: Intermittent Detonation Liquid Riot Weapon

AUTHORIZED FUNDING: \$469

TASK DURATION: 11 September 1968 to 27 June 1969

DESCRIPTION AND RESULTS: This is an experimental item intended to fire finite slugs of water with sufficient force to deter, but not to be lethal. It is a hand-held device consisting of a vertical tube with a combustion chamber at the top, and a 90 degree turn at the bottom. Fuel and air are supplied to the combustion chamber where it is ignited by a spark to produce a detonation and a shock wave which is focused down the tube. The momentum of the shock wave transfers to the column of water standing in the vertical tube, and expels it from the tube. The cycle is repeated for the next water slug.

Feasibility tests were conducted. Force and range characteristics were not sufficient to warrant additional development.

TASK NUMBER: 06-M-69

TITLE: Fire Fighter

AUTHORIZED FUNDING: \$75,897

TASK DURATION: 24 September 1968 to 21 November 1969

CONTRACTOR: John W. Stang Manufacturing

DESCRIPTION AND RESULTS: The system, to accomplish the destruction of canal bank bunkers, to remove underwater barriers, and to provide a defoliation capability, is essentially a hydraulic mining device consisting of two high pressure water guns supplied by a single pump and a 420 hp 12V71 diesel engine combination capable of delivering 1750 gpm at 200 psi. It features a steering augmentor utilizing water jet reactions, and a bow mounted channel clearing device. The system designed to be installed on an ATC (Armored LCM-6) weighs approximately 26,500 pounds without water. Over-all dimensions are 6 feet x 9 feet x 18 feet.

Tests at Aberdeen Proving Ground, Maryland, indicated that this system can render a bunker inoperative within two minutes. Maximum effective range is 50 to 70 meters.

The system received a preliminary test at the NIOTC, Mare Island, California, prior to shipment to Vietnam. The test indicated that all design goals were met except weight. The system was shipped to Vietnam in February 1969. U. S. Army Mobility Equipment Command was the designated parent agency for this item.

B-207

TASK NUMBER: 07-M-69

TITLE: Standard Revetment Structure Study

AUTHORIZED FUNDING: \$39,625

TASK DURATION: 10 October 1968 to 14 September 1970

DESCRIPTION AND RESULTS: Tests of fiberboard, wax impregnated plywood, and aluminum and steel corrugated panels were conducted using dry and wet sand, earth, and clay. Various expedient designs and the existing Air Force design were tested for ability to withstand loading impact and hydraulic force from water saturated clay. The Air Force type of steel revetment was modified to eliminate rework required when a system is assembled. This modified design was recommended for consideration as a standard revetment kit.

TASK NUMBER: 09-M-69

TITLE: Riot Control Patrol Vehicles (RC)

AUTHORIZED FUNDING: \$35,695

TASK DURATION: 27 February 1969 to 12 October 1970
Reopened: 11 August 1971 to 25 February 1972

DESCRIPTION AND RESULTS: The Riot Control Hardtop Kit is a hardtop enclosure kit for the M151 vehicle with 5/8-in. thick acrylic plastic windows and an expanded core laminated ABS plastic roof. The kit provides comparative safety to patrolling forces in a riot control mission by resisting thrown objects such as bricks, stones, fire bombs, and concrete blocks dropped from an overpass. The doors have inside locking latches, the hood is secured, and the gasoline cap is tamper-proof. A ventilating fan exhausts air for hot weather operation.

Five kits were fabricated and evaluated by CONARC. They were found to be acceptable for their intended use. Details are contained in "Evaluation Test Results for Protective Hardening Kit, 1/4-Ton Truck, 437th Military Police Co., 519th Military Police Bn, Fort Meade, MD," 22 Dec 70; and letter, CONARC, ATIT-RD-MD, dtd 9 Feb 71. It was anticipated that production engineering and procurement of the items for troop use would be conducted by AMC.

TASK NUMBER: 10-M-69

TITLE: Model AV8E-1001 Commercial All-Terrain Vehicle for RVN Evaluation

AUTHORIZED FUNDING: \$15,461

TASK DURATION: 3 April 1969 to 3 October 1969

DESCRIPTION AND RESULTS: The item is a two-unit articulated, eight wheel, 8' x 8' vehicle; 50 inches over-all width by 126 inches over-all length. Its empty weight is 600 lbs, and payload capacity is 4 people or 750 lbs of cargo including the operator. It is a commercial vehicle intended by the manufacturer for use by fishermen, hunters, mountain explorers, etc. Capable of operation over most types of difficult terrain, including soft wet terrain and steep mountain grades up to 100%, the vehicle appears to be a candidate, when militarized, for use in Vietnam as a utility support load carrier. Two vehicles were procured for concept evaluation in Vietnam and shipped in July 1969.

TASK NUMBER: 01-M-70

TITLE: Low Tractive Effort Dozer Blades

AUTHORIZED FUNDING: \$224,754

TASK DURATION: 11 August 1969 to 23 April 1974

CONTRACTOR: Mississippi State University; Caterpillar Tractor Company

DESCRIPTION AND RESULTS: The Low Tractive Effort Dozer Blade reduces tractive effort by vibrating the blade. The design goal was to upgrade the performance of a D-5 tractor and blade to that of a D-6 tractor and blade, while keeping the weight within airmobile limitations.

Scale model and full size testbed tests were conducted. The results showed that dozing productivity can be increased substantially by vibrating the blade at approximately 10 cycles/second and 1-1/2 inches in amplitude. Additional studies and tests were conducted over a wider range of frequency and amplitude, and for different directions of vibration. Also, solutions to the problems of adverse vibration effects on the dozer equipment were studied.

TASK NUMBER: 02-M-70

TITLE: Improved Elevated Site Marker (USARV)

AUTHORIZED FUNDING: \$14,631

TASK DURATION: 14 August 1970 to 25 February 1972

DESCRIPTION AND RESULTS: The Improved Elevated Site Marker is used by individuals or units to mark a ground location in areas of dense vegetation. The marker is observable from aircraft flying at altitudes up to 2000 feet at a slant range of one mile. A xenon flashing light for night capability is also provided. The marker is used to mark forward limits of friendly forces and to provide a reference point for aerial resupply, and target marking.

The system is carried in a nylon O.D. container equipped with pistol belt snap hook and strap and weighs approximately 4 pounds. Seven hundred systems were shipped to the Marine Corps and seventy systems to USARV in 4th Qtr FY71.

TASK NUMBER: 03-M-70

TITLE: Individual Sandbagging Aids

AUTHORIZED FUNDING: \$4,426

TASK DURATION: 19 January 1970 to 3 August 1970

DESCRIPTION AND RESULTS: In the development of the lightweight and medium weight sandbagging machines, experience was gained in rapidly handling sandbags. This task was a study of the possibility of practical utilization of that knowledge in the design of simple hand actuated aids for the individual soldier filling sandbags. Emphasis was placed on using equipment already in the inventory as basic implements. One such device used two standard entrenching tools as a bag holder. Adaptations of the bag holder used on the sandbagging system, and a mechanically actuated version of the hydraulic stapler from the same machine were also investigated.

TASK NUMBER: 04-M-70

TITLE: Portable Battalion Tactical Operations Center

AUTHORIZED FUNDING: \$72,527

TASK DURATION: 10 February 1970 to 17 September 1971

DESCRIPTION AND RESULTS: The BTOC is a single module shelter, with a floor, for use as a bunkered tactical operations center - a communications base from which the Battalion Commander can direct the activity of his troops. It is approximately seven ft wide by six and one-half ft high by twelve ft long inside dimensions and weighs approximately 3,500 lbs including all ancillary equipment such as radios, mounts, antennas and tables. The BTOC command module is transportable by CH-47 helicopter and by the 2-1/2 ton truck. Five feet of sandbags will allow it to withstand a direct hit by a point detonating 122mm rocket round.

The single modular unit will accommodate five to seven people and function as the BTOC in a rapidly changing situation. For semi-permanent type positions, two or more module units can be connected to form a larger CP.

Design and fabrication of two testbed model modules was completed. Firing tests using 81mm mortar and 122mm rocket rounds were successful. Due to the draw-down in Vietnam, the requirement was withdrawn.

TASK NUMBER: 01-M-71

TITLE: Locking Device for Military Vehicles

AUTHORIZED FUNDING: \$28,450

TASK DURATION: 20 July 1970 to 25 February 1972
Reopened: 20 July 1972 to 23 March 1973

DESCRIPTION AND RESULTS: The locking device is an accessory steering wheel lock which can be installed on tactical vehicles. It is more convenient and more effective than the chain and padlock methods used as field expedients. The key lock is installed on the vehicle steering column. When not locked, the key is retained in the cylinder. The lock cylinder may be removed to deactivate the lock, or replaced to maintain key security. For new production vehicles the lock would be manufactured integral with the vehicles, but would have the same features.

An evaluation of 380 items was completed in RVN. The Suitability Statement recommended type classification for all existing vehicles with steering wheels. TACOM was assigned as the parent agency. Ten units were furnished to CDTC-V for evaluation and possible in-country production. Five units were furnished for evaluation by ARPA-RDFU-Thai.

TASK NUMBER: 03-M-71

TITLE: Test and Evaluation of Vehicle Heaters

AUTHORIZED FUNDING: \$164,977

TASK DURATION: 24 July 1970 to 13 April 1973

DESCRIPTION AND RESULTS: The Eberspacher Swingfire Heater and installation designs for several vehicles were evaluated. The heater operates on the principle of intermittent combustion - like a pulse-jet engine - and requires no electric power for operation. Only 150 watts of power are required for starting - for 1 to 3 min duration depending on the ambient temperature. The exhaust gases power a turbine which drives a fan to produce a flow of pure warm air for personnel space heating. The exhaust gases are used to warm engine coolant and oil. Total heat output is 40,000 BTU per hour. Quick preheating from temperatures of -65°F can be achieved in one hour. Extended standby heating does not drain the vehicle batteries. In the portable mode the heater may be used to thaw drive-line components and bearings or to preheat auxiliary equipment such as generators and compressors.

Installations were designed for the M151A2, 1/4-Ton Truck; M135A2, 2-1/2-Ton Truck; and the M149, 400 gal. Water Trailer. Engineering Design Tests were conducted at APG, MD, and Military Potential Tests were conducted at the Arctic Test Center. Excellent results were obtained for quick preheating, standby heating, reliability, and maintainability. The portable capability was judged to be valuable. Air distribution within the cab needed improvement for defrosting and personnel heating.

TASK NUMBER: 04-M-71

TITLE: Lightweight Aerodynamic Balloon Position Marker

AUTHORIZED FUNDING: \$5,107

TASK DURATION: 27 July 1970 to 23 April 1971

DESCRIPTION AND RESULTS: The purpose of the Lightweight Aerodynamic Balloon Position Marker is to make known to friendly aircraft the location of ground units operating under a heavy jungle canopy. The system is essentially a second generation of the Improved Elevated Site Marker which has a brightly colored aerodynamic shaped balloon to improve performance in wind tethered by a 300 foot line.

The balloon is inflated with hydrogen generated from a solid chemical source. A flashing xenon light is provided for a night capability. Total system weight is approximately 2 pounds.

An aerodynamic shaped balloon was developed but the hydrogen generator development was incomplete. The task was cancelled until it was determined whether a second generation of the Improved Elevated Site Marker was needed and until comparative tests could be made with a similar Navy system that is propelled through and inflated above the jungle canopy.

B-217

TASK NUMBER: 05-M-71

TITLE: Frozen Ground Implement

AUTHORIZED FUNDING: \$12,450

TASK DURATION: 28 July 1970 to 17 September 1971

DESCRIPTION AND RESULTS: The Frozen Ground Implement consists of two tools: (1) a 65-pound gasoline engine driven concrete and pavement breaker and drill and (2) a rock splitting tool which is a tube 2 in. in diameter by 36 in. long containing a charge of liquid CO₂. The concept is based on the fact that frozen ground exhibits essentially the same characteristics as rock and concrete, therefore, can be worked by tools for breaking rock and concrete. The system functions by inserting the CO₂ tube into a hole of the desired depth and activating it with a battery initiator. Sixty-five to seventy standard cu. ft of gas is generated, splitting and breaking the frozen ground into manageable chunks which can be moved by hand or earth working tools. The operator need be only ten ft away, just out of fracture range of the tube.

Preliminary tests were conducted in frozen ground. Since the results were not too promising, the task was terminated.

TASK NUMBER: 06-M-71

TITLE: Silent Patrol Boat

AUTHORIZED FUNDING: \$49,803

TASK DURATION: 7 August 1970 to 17 December 1971

DESCRIPTION AND RESULTS: The "Silent Patrol Boat," designed for use in Korea, is a shoal draft inboard powered patrol craft. The boat presents a low profile, is unsinkable, and is fabricated from readily repaired plastic materials. Power is supplied by an air-cooled standard military engine 4A084 of 20 to 35 horsepower. The engine drives a standard propeller housed in a tunnel which is of sufficient depth so that nothing protrudes below the hull bottom. Quietness is attained by selective muffling and sound damping.

A full-scale test unit was constructed and preliminary testing was completed. Hydrodynamic performance was as predicted in both shallow and deep water. The air-cooled standard military engine 4A084 provided sufficient power but could not easily be kept within temperature specifications at the higher power settings (these settings are above the continuous rating level). Due to a change in U. S. Army posture in Korea, the requirement was no longer valid. The task was cancelled prior to construction of evaluation units.

TASK NUMBER: 07-M-71

TITLE: Feasibility Pulsed Jet Water Cannon

AUTHORIZED FUNDING: \$22,231

TASK DURATION: 27 November 1970 to 17 September 1971

CONTRACTOR: Exotech

DESCRIPTION AND RESULTS: The pulsed jet water dispenser system being developed is capable of rapid repetitive pulses. The intermittent pulses permit operation at a higher power level than a continuous pumping system, and water is conserved. The reduced weight and volume of the system permits greater flexibility in vehicle installation and operator protection. The pulsed jets of water are ejected by 12-gauge shotgun type propellant cartridges, with an automatic feed and ejection system.

The water will deter a crowd at 90 feet at a pulse rate of 2 shots per second, and will provide a stand-off of 75 feet. The system will permit evaluation of a pulsed water system for crowd deterrence.

TASK NUMBER: 08-M-71

TITLE: Remote Boat

AUTHORIZED FUNDING: \$71,385

TASK DURATION: 27 November 1970 to 3 March 1972

DESCRIPTION AND RESULTS: The "remote" boat is a remotely controlled (via radio line) unit. The radio control is an adaptation of commercially available proportional control commonly used for model aircraft. Four channels are provided. Power on and off, rudder, and two channels can be used at the users discretion.

Power is provided by sealed lead-acid batteries powering two direct drive counter rotating DC motors. The molded plastic hull may be broken down into two approximately equal length components to simplify handling.

An evaluation quantity of boats was sent to RVN during the 3rd Qtr FY72, and operator training sessions were conducted near a potential use area. The user agency indicated that due to a changing situation the requirement for which the boats were designed no longer existed and returned the full quantity of boats to USALWL.

TASK NUMBER: 09-M-71

TITLE: Rough Terrain Ground Handling System for Helicopters

AUTHORIZED FUNDING: \$116,201

TASK DURATION: 8 February 1971

CONTRACTOR: Barnes & Reinecke, Inc.

DESCRIPTION AND RESULTS: In some areas of operation, it is desirable to move helicopters adjacent to or into the tree line for concealment purposes. The present ground handling wheels are not adequate for unprepared terrain.

A self-powered handling system was developed which readily attaches/detaches utilizing the existing ground handling wheel pick-up points. It consists of two self-powered belt track units and a cross structure to support the helicopter. The test unit is configured for use with the UH-1 series helicopters, but could be readily modified to accept any skid helicopter.

The unit weighs about 1200 lbs. and disassembles into component sizes that can be carried aboard a UH-1 helicopter. It is controlled by one man from either side, or at a station forward of the helicopter. Engineering design tests were completed the 3rd Quarter of FY74 and prototype made available to MASSTER.

TASK NUMBER: 10-M-71

TITLE: Liquid Projector, Feasibility

AUTHORIZED FUNDING: \$6,162

TASK DURATION: 10 March 1971 to 8 December 1971

DESCRIPTION AND RESULTS: The feasibility of projecting water-filled spheres, designed to burst on impact, was investigated as a low lethality method of crowd control. The 3-in. diameter spheres are made of flexible plastic, and are designed to rupture in orange peel fashion on impact at a predetermined pressure. Since the sphere bursts early in the impact interval, the force and penetration are limited by the uncontrolled dissipation of the water. The blow is painful, but limited in injury effect. The spheres are launched from an adaptor which fits on the end of a standard 12 gauge shotgun. A blank cartridge propels the sphere at 160 ft per sec. A styrofoam sabot is used to prevent rupturing of the sphere and discarded after launching. Maximum range is approximately 400 ft, with an effective engagement range estimated to be from 20 to 100 ft.

Developmental tests were conducted to determine feasibility and effectiveness, and to define system parameters. Limited animal tests indicated superior results compared to both the "beanbag" and the rubber bullets.

TASK NUMBER: G1-M-72

TITLE: Portable Pumping System

AUTHORIZED FUNDING: \$64,293

TASK DURATION: 6 July 1971 to 28 February 1974

CONTRACTOR: FMC Corporation

DESCRIPTION AND RESULTS: When directed to conduct civil disturbance operations, Military Police and National Guard units may be required to hold back a mob without causing permanent injuries to individuals in the mob.

Two water systems have been developed: an engine-driven pumping system and a cartridge-actuated system. Further development and testing of both systems were conducted under this task. The engine-driven system includes an 800-gallon water tank. The entire system can be mounted as a unit and operated on a 2-1/2-ton truck. The cartridge-actuated system is capable of rapid repetitive pulses. The intermittent pulses permit operation at a higher power level with less parasitic weight and volume than a continuous pumping system, and water is conserved. The pulsed jets of water are ejected by 12 gauge shotgun type propellant cartridges, with an automatic feed and ejection system.

The engine-driven system has the capability of preventing a man from approaching closer than 75 feet, at a pumping rate of 100 gallons per minute. Water can be conserved by means of valve which can be rapidly opened and closed by means of an electric motor. There is provision for injecting liquid additives into the water system.

Effectiveness/Lethality tests were conducted with both systems. Developmental modifications were made to the feasibility model cartridge-actuated system to overcome problems in the rapid-fire mechanism.

B-224

TASK NUMBER: 02-M-72

TITLE: High Performance Helicopter Utility Hoist

AUTHORIZED FUNDING: \$357,208

TASK DURATION: 10 August 1971

CONTRACTOR: Lockheed Missiles & Space Company, Inc.

DESCRIPTION AND RESULTS: A feasibility and engineering design study was made of a flywheel powered high performance hoist for helicopters. A preprototype hoist was developed for Military Potential Tests.

The intermittent hoisting power requirements are supplied by a high strength steel flywheel, which is continuously driven by a D.C. electric motor. Retrieval speed was increased five times. Total hoisted load capacity per mission is 1800 lbs. in various combinations of 200 to 600 lbs. per retrieval. A clutch provides for smooth acceleration and deceleration of the load. The design is configured for a UH-1 helicopter for military potential tests, and is compatible with the future Utility Tactical Transport Aircraft System. Emphasis was placed on reliability of operation, ease of maintenance, and human factors. Testing, including user evaluation at MASSTER, was still in progress at the time of deactivation.

B-225

TASK NUMBER: 03-M-72

TITLE: Investigation-External Combustion Engines

AUTHORIZED FUNDING: \$19,183

TASK DURATION: 11 August 1971 to 13 July 1972

DESCRIPTION AND RESULTS: An investigation of the characteristics of closed cycle external combustion engines was conducted to determine if any fell within the state-of-the-art for application as a low noise level propulsion system for watercraft. Comparisons were made of the various developmental engines with regard to noise level, size, weight, fuels, cost and state of development.

A report was completed which states that, although a large effort is underway toward the development of many different types of external combustion engines for reduction of vehicle power plant pollution, there are no engines available at this time that are suitable for test application for low noise level boat operation.

B-226

TASK NUMBER: 04-M-72

TITLE: Pulsed Jet Water Cannon

AUTHORIZED FUNDING: \$121,944

TASK DURATION: 11 August 1971 to 9 August 1973

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: As an approach to an effective and humane means of crowd control, an experimental program was conducted to determine the feasibility of a water cannon which would project pulses of water, instead of a continuous stream. The experimental single shot system was capable of varying the diameter, length and pressure of the water jet in order to investigate the effect of these variables on the performance of the water jets. The intermittent water stream is expected to utilize the water supply more efficiently than a continuous stream, and to reduce power requirements. The effective deterrent range was approximately 90 ft, and the maximum range was approximately 150 ft, using 175 psi propelling gas pressure through a 1-3/8-in. diameter nozzle. Developmental tests were conducted to determine optimum system parameters, and feasibility was established.

B-227

TASK NUMBER: 05-M-72

TITLE: Air Cushion Field Dolly

AUTHORIZED FUNDING: \$59,814

TASK DURATION: 21 January 1972 to 26 February 1974

DESCRIPTION AND RESULTS: In some air-mobile operations it is necessary to move helicopters, small aircraft, and various logistic items of support materials and equipment over unprepared terrain and into tree lined areas.

The Air Cushion Field Dolly is capable of handling loads up to 10,000 lbs. over unprepared terrain. The basic design is sized to carry the UH-1 helicopter, though the dolly is designed to carry any type cargo - i.e. drums of fuel, ammunition, rations, construction materials, etc.

The Air Cushion Field Dolly consists of an air-inflated basic structure, with hard structure as required to support the helicopter or cargo. Power is supplied for lift only. Propulsive power and control is to be provided by man-power or by a ground vehicle.

B-228

TASK NUMBER: 06-M-72

TITLE: Locking Device for Vehicle Radios

AUTHORIZED FUNDING: \$6,190

TASK DURATION: 3 March 1972 to 29 May 1973
Reinstated: 12 July 1973 to 27 February 1974

DESCRIPTION AND RESULTS: A key locking device replaces one of the clamps which attach the radio to the radio mount. The radio mount is attached to the vehicle with break-off security bolts. Seventy-five devices were sent to USAREUR for user evaluation.

B-229

TASK NUMBER: 07-M-72

TITLE: Scratch Resistant Plastic Windows for M151 Truck

AUTHORIZED FUNDING: \$6,204

TASK DURATION: 24 March 1972 to 23 March 1973

DESCRIPTION AND RESULTS: A plastic window material was used which has a scratch resistant silica coating. The material can be folded loosely, but cannot be creased flat. It is almost as scratch resistant as glass. Cost is substantially higher than for the vinyl plastic materials currently used. A quantity was sent to USAREUR for user evaluation.

TASK NUMBER: 01-M-73

TITLE: UH-1 Door Gunner Protection

AUTHORIZED FUNDING: \$28,331

TASK DURATION: 24 July 1972 to 10 September 1973

DESCRIPTION AND RESULTS: Cold weather protection was required for door gunners and crews of UH-1D/H helicopters operating in cold and arctic regions during take-off and landing. Protection to the crew is provided by installing sliding doors and fixed panels which seal off the door gunner's area from the rest of the cargo and crew space. The gunners are outfitted with heated suits. The main doors can be opened and closed to permit door gunner operations or rapid disembarking of troops while the inner doors are either open or closed. The kit can be installed or removed in about a half hour without modification to the helicopter. The system was tested in Alaska. Preliminary comments from Alaska were favorable. Some criticism was directed at the heated suit.

TASK NUMBER: 02-M-73

TITLE: Field Fortification Kit

AUTHORIZED FUNDING: \$58,563

TASK DURATION: 24 July 1972 to 26 February 1974

DESCRIPTION AND RESULTS: The Field Fortification Kit consists of two basic component items: panels and connectors. The panels are of a number of lengths such that a variety of bunker/revetment configurations are possible. Assembly is by hand with no tool requirements. The assembled components form free-standing double-walled structures of sufficient thickness, when filled with any dry available soil, to provide full protection from a near miss. The earth-filled structure is capable of supporting additional layers of sandbags, and a sandbagged roof, if desired. The Field Fortification Kit, when supplied in appropriate quantity and component parts mix, provides a universal system of rapidly emplaceable fortifications. Specific applications are to living/fighting bunkers, gate and perimeter guard positions, small TOC's, and helicopter and barracks revetments.

Prototype Field Fortification Kits were designed and fabricated. Typical bunkers and revetments were erected and tested at APG by the MTD, USATECOM. Test results indicated that the concept is sound, and that it is a practical means for providing bunkers and revetments for universal troop use application.

TASK NUMBER: 03-M-73

TITLE: Balloon Marker

AUTHORIZED FUNDING: \$117,465

TASK DURATION: 2 August 1972

CONTRACTOR: NSA Research Corporation

DESCRIPTION AND RESULTS: The system consists of: An aerodynamic balloon, 300-ft. tether line, a solid-state hydrogen gas generator, xenon flashing light, and a carrying case. The components are not packaged as a system but stocked as distinct and separate items. This permits requisitioning as needed to meet particular user needs.

Balloons and gas generators were developed. System tests were conducted, and evaluation quantities procured. Evaluation was still in progress at the time of deactivation.

TASK NUMBER: 04-M-73

TITLE: Powered Wheels for Helicopters

AUTHORIZED FUNDING: \$44,051

TASK DURATION: 18 October 1972

DESCRIPTION AND RESULTS: The powered wheels are based on the present standard UH/AH-1 ground handling wheels. Power is in the form of standard gasoline engines driving the wheels through a mechanical drive train. The system is designed for unimproved, but relatively regular terrain with minimal slope or ditch size.

Each wheel unit is of such a size and weight that it can be easily handled by a ground crew of no more than two men. The units attach to the helicopter at the existing skid pick-up points. Control is from a single location on either side of the helicopter. Test units were tested at APG and shipped to MASSTER.

B-234

TASK NUMBER: 05-M-73

TITLE: Abrasion Resistant Props

AUTHORIZED FUNDING: \$3,428

TASK DURATION: 15 December 1972 to 8 February 1974

DESCRIPTION AND RESULTS: Propellers on river boats in silt laden waters abrade rapidly. River boat propellers were coated with a scratch resistant dispersion coating of a polymer of vinylidene fluoride (Kynar). The coating is tough, abrasion resistant, and has low friction properties. A quantity was sent to USARAL for user evaluation.

TASK NUMBER: 06-M-7C

TITLE: Anchor Capstan Kits for Wheeled Vehicles

AUTHORIZED FUNDING: \$8,495

TASK DURATION: 25 January 1973

DESCRIPTION AND RESULTS: The anchor capstan system is a complete vehicle self-recovery system in kit form. The system consists of: adapter plates that are installed on two of the vehicle drive wheels, capstans that are installed on the adapter plates, two cables or ropes 75 feet in length, and two self-emplacing earth anchors. The adapter plates are installed semi-permanently on the wheels. For a recovery operation, the capstans install on the adapter plate in approximately two minutes by means of a simple T-handle bolt. The vehicle can winch itself out with total vehicle power, using either the earth anchors or an available tree as a deadman.

Kit design and Engineering Design Tests were conducted at APG. Kits for field evaluation were fabricated and these tests were in progress at the time of deactivation.

TASK NUMBER: 07-M-73

TITLE: Riot Control Barrier

AUTHORIZED FUNDING: \$11,897

TASK DURATION: 25 January 1973 to 26 February 1974

DESCRIPTION AND RESULTS: The Riot Control Barrier is a quickly erectible vision blocking screen which will hold back "determined" crowds along its line of application, generally envisioned as extending 75 to 300 feet. It is weatherproof; invulnerable to thrown gasoline fire bombs, and not adversely affected by riot control agents.

It consists of modular units of barrier wall (each unit approximately 3 feet long). Cross section of the wall is an approximate equilateral triangle with 8-foot long sides; the base and the sides are corrugated panels. The panels are hinge pin connected such that the modules are collapsible for shipment and storage. The triangular sectioned modules are connected end to end, with an overlap of the corrugated panels, to provide the desired length of barrier wall. If the rioting crowd is successful in turning over the triangular sectioned wall, the net effect is only that the wall has been moved forward by approximately 8 feet.

TASK NUMBER: 08-M-73

TITLE: Engineer Test and User Evaluation of UNA-Track Kit

AUTHORIZED FUNDING: \$41,328

TASK DURATION: 12 February 1973 to 26 February 1974

DESCRIPTION AND RESULTS: The UNA-Track Kit consists of four each independent track assemblies which mount onto the wheel hubs of existing four-wheel drive vehicles, the track units replacing the wheels on a one for one basis. No vehicle modification is required. The kit is adaptable to military vehicles in the 1/4-ton to 1 1/4-ton class (M151 and M715/725).

The UNA-Track Kit weighs approximately 700 lbs. (175 lbs. per track assembly). Each track assembly is 18" wide by 66" long. The track body, bogie and idler wheels, and sprocket are aluminum. The track is the commercially patented "FASTRAC", made of DuPont Hytrel polyester Elastomer. The track is made of segments joined by spring steel rods, making it economical and easy to replace individual segments. Engineer-Design Tests were conducted at APG and further testing in Alaska.

TASK NUMBER: 09-M-73

TITLE: UH-1 Ground Handling Wheel Adapter Bar for OH-58 Helicopters

AUTHORIZED FUNDING: \$10,187

TASK DURATION: 1 March 1973 to 26 February 1974

DESCRIPTION AND RESULTS: In response to the Army's need to move OH-58 helicopters over difficult terrain areas, USALWL devised and developed the UH-1 Ground Handling Wheel Adapter Bar System for OH-58 Helicopters. The system was feasibility tested by USAATB, Fort Rucker. It was user evaluated by MASSTER and 1st Cav. Div. at Fort Hood, and by 101st Airborne Div. at Fort Campbell. Conclusions indicate that the UH-1 Ground Handling Wheel Adapter Bar System can provide the Army with a safe, practical, and suitable means for ground handling the OH-58 helicopters over unprepared terrain.

TASK NUMBER: 01-M-74

TITLE: Arctic Sled

AUTHORIZED FUNDING: \$5,000

TASK DURATION: 13 August 1973

DESCRIPTION AND RESULTS: The current standard arctic sled, 200-lb capacity, lacks steering and downhill control, and is not sufficiently durable in arctic cold weather conditions.

The standard Canadian sled was procured by LWL and evaluated by the Arctic Test Center on behalf of USARAL. Optimum design characteristics were to result from the evaluation.

Initial user input indicated that a rigid towing handle should be incorporated to provide steering control on slopes and downhill braking. One Canadian sled was modified by applying a low friction material to the bottom surface. Evaluation was in progress at the time of deactivation.

TASK NUMBER: 02-M-74

TITLE: Evaluation of Vehicle Tire Chains for Army Use in Alaska

AUTHORIZED FUNDING: \$3,500

TASK DURATION: 18 January 1974

DESCRIPTION AND RESULTS: Standard chain-link type tire chains are difficult to install and frequently break in use, especially on paved roads. USARAL requested an evaluation of several cable-type traction devices which may offer advantages over conventional tire chains for passenger cars. Also, there is a requirement for sizes to fit cargo vehicles.

USARA identified two types of traction devices, commercially available, which they believe have promise. A survey was made of other available types, and several types were selected for tests. Evaluation was still in progress at the time of deactivation.

TASK NUMBER: 20-M-74

TITLE: Evaluation of Field Fortification Kit (MASSTER)

DESCRIPTION AND RESULTS: The Field Fortification Kit consists of two basic components: Corrugated aluminum panels and galvanized wire rope connector assemblies. The kit includes a specified number each of five (5) different length panels, the assortment of panel lengths making it possible to make a variety of bunker/revetment configurations. Assembly is by hand with no special tool requirements. The assembled components form freestanding, hollow-wall structures of sufficient thickness to provide, when filled with any available soil, protection from direct hits by 81mm mortar rounds. The earth-filled structures are capable of supporting additional layers of sandbags and a sand-bagged roof. The sandbagged roof is capable of protection against direct hits by 81mm mortar shells.

One Field Fortification Kit consists of an appropriate number of components to emplace one (1) typical UH-1 Helicopter revetment or one (1) typical living/fighting bunker.

The prototype Field Fortification Kit was shipped to MASSTER.

TASK NUMBER: 01-S-63

TITLE: Individual Survival Kit (Hot-Wet)

AUTHORIZED FUNDING: \$31,600

TASK DURATION: 17 December 1962 to January 1964

CONTRACTOR: Geometrics, Inc.

DESCRIPTION AND RESULTS: Design and develop an individual aid and survival kit to conform to the approved Small Development Requirement received by this Laboratory on 10 December 1962. This task involved the development of 35 components to include a logistic-free fire making device, survival articles, escape items, individual treatment medical items and specially tailored packaging and carrying devices. The kit includes two sub-kits - an operational and a reserve kit which contains all of the components called for in the Small Development Requirement except for the food items. The former is for day-to-day use and the reserve for use when in an evadee status. The medical and utility components of the kit are designed to provide adequate medical supplies and the capability of providing shelter and foraging for food for up to ten days of evasive action by an individual who is ambulatory and in a good state of nutrition. No food items are included in the survival kit in view of the overall weight and volume of the food that would be required to sustain an individual for a ten-day period.

Concept design was approved in January 1963 and a prototype model was presented to and demonstrated to the Commanding General of the U. S. Army Special Warfare Center on 21 February 1963. As a result of this meeting, necessary modifications were made to the prototype model and test quantities were produced.

The survival kit was subjected to an extensive test and evaluation by Special Forces Troops under the supervision of U. S. Army Test and Evaluation Command. This evaluation was conducted at Fort Bragg, North Carolina and the Panama Canal Zone during the period 21 March to 4 April 1963. Necessary modifications to the kit have been made to incorporate the test report recommendations. Four thousand of the operational kits and 600 of the reserve kits were assembled for delivery to the U. S. Army Special Warfare Center.

B-243

TASK NUMBER: 02-S-63

TITLE: Improved Machete

AUTHORIZED FUNDING: \$5,150

TASK DURATION: 17 December 1962 to 6 September 1963

DESCRIPTION AND RESULTS: Design and develop a light, well-balanced machete with an optimized center of percussion, employing technologically updated materials and adequately human engineered handle and sheath. A sharpener of non-corroding materials with embedded abrasives will be included. This will fulfill the same purpose as the standard machete, but will be more effective.

Several prototypes featuring 12 and 15 inch length blades were developed with modified handles. The results of informal tests conducted in the United States and Panama revealed that additional modifications in the weight and balance of the blade were required.

B-244

TASK NUMBER: 03-S-63

TITLE: Flashlight for Special Forces

AUTHORIZED FUNDING: \$781

TASK DURATION: 17 December 1962 to 6 September 1963

DESCRIPTION AND RESULTS: Develop a lightweight, waterproof flashlight with multi-color signalling capability for use by troops in tropical areas. This would be a small, cheap, "throw-away" item to provide emergency illumination for signalling and to aid vision at night.

Several experimental models were made in-house, using a variety of materials and types of batteries, bulbs, etc, before cancellation of the task.

TASK NUMBER: 05-S-63

TITLE: Clasp Knife for Special Forces

AUTHORIZED FUNDING: \$3,559

TASK DURATION: 17 December 1962 to 6 September 1963

DESCRIPTION AND RESULTS: Develop a lightweight, well-balanced knife incorporating modern materials to retain sharpness. It will require little or no maintenance. Purpose of this knife is to provide a defense and general utility knife. This knife will augment the survival kit for Special Forces Operational Detachment members.

Three sample prototype knives were built and given preliminary in-house tests prior to cancellation of the task.

B-246

TASK NUMBER: 06-S-63

TITLE: Collapsible Canteen

TASK DURATION: 17 December 1962 to January 1964

DESCRIPTION AND RESULTS: Provide a redesigned canteen which can be readily filled from still or slowly flowing water. The canteen will be in the form of two baseless cones joined along their peripheries and inclosing a stiffening wire ring in its edge. The canteen will have a diameter of approximately 14 centimeters, a thickness of 5 centimeters and a capacity of approximately two quarts. The filler neck cap will be designed so that water purification tablets can be carried within it. The concept and design were completed and work was transferred to Task 11-B-63.

TASK NUMBER: 07-S-63

TITLE: Lightweight Pioneer Tools

AUTHORIZED FUNDING: \$2,983

TASK DURATION: 17 December 1962 to 6 September 1963

DESCRIPTION AND RESULTS: Develop a series of lightweight pioneer tools designed for tropical use. Each tool of the set is to be human engineered for compatibility with the various users, particularly from the standpoint of weight and mode of use. Materials used are to be those best suited for minimum deterioration in the tropics. The tools are to have hollow metal handles with modern alloy cutting edges. These tools are to be used for improvised bridging, clearing fire lanes and helicopter sites, building shelters, digging weapon emplacements, clearing trails and roads, etc.

Sample axes and other tools were investigated as to cutting edge, weight, and balance. A prototype model axe which incorporates the desirable features of axes studied was made. Changes to original prototype as determined by preliminary in-house tests were incorporated into a second prototype model.

TASK NUMBER: 08-S-63

TITLE: Tree Climbers

AUTHORIZED FUNDING: \$2,619

TASK DURATION: 17 December 1962 to 6 September 1963

DESCRIPTION AND RESULTS: Design and develop tree climbing irons of approximately one pound weight for climbing into the jungle canopy to conduct observation, communications, etc. The proposed tree climbing irons would have a bark penetrating spike at the instep, a strap across the in-step, a metal bar under the instep, and a lever arm up the outside of the leg to a point above the ankle where a wide soft strap would distribute the strain.

A lightweight, prototype model with the leg bar on the outside for better weight distribution was constructed before cancellation of the task.

TASK NUMBER: 09-S-63

TITLE: Electric Probe

AUTHORIZED FUNDING: \$6,033

TASK DURATION: 3 March 1963 to 25 March 1965

DESCRIPTION AND RESULTS: Modify, as necessary, commercial electric probes and batons in order to develop an effective riot control instrument. The instrument is to be as similar in appearance as possible to the standard U. S. Army Military Police Baton so as not to attract undue attention. It will be light in weight and have maximum shocking ability within limits of safety.

The Electric Probe developed by LWL is a two handed offensive and defensive weapon for use in riot control operations. The probe consists of a cylindrical 1-1/8" plated steel tubing covered with 1/8" black vinyl sleeving, measuring 36" long, with helical electrodes located along the center 8" of the shaft and with two probes on one end. The electrodes are connected to the output of a transistorized oscillator which is located in the handle and is powered by six 1.5 volt alkaline batteries. By closing a spring-loaded switch located above the handgrip, the user can impart a 4,000 volt shock to anyone coming in contact with the electrodes. The item weighs 3 pounds 3 ounces with batteries. Prototypes were designed and fabricated and a proposed SDR forwarded to the Military Police Agency for action.

TASK NUMBER: 11-S-63

TITLE: Canopy Exploitation and Penetration

AUTHORIZED FUNDING: \$625,387

TASK DURATION: 3 March 1963 to 16 January 1967

DESCRIPTION AND RESULTS: Design and fabricate a device which can be lowered onto the jungle canopy by helicopter or other aircraft, so that a "staging" platform can be installed in the top of the jungle growth. This platform will serve as a base for on or off-loading of troops and materiel, for evacuation of casualties, observation post, installation of a remote listening station, bivouacking in the jungle canopy for increased security, etc.

The Canopy Platform System consists of two 20'x150' nets made of steel cable, a net dispenser rack carried as a sling load under a rotary winged aircraft for transporting and laying the nets and a hexagonal space-frame 18 foot diameter platform. The nets have a six-inch square mesh on the ends to engage branches in the tree tops. The nets are laid one across the other forming a cross (+) with the platform deposited at the vertex. Powered hoist and davits are installed on the platform for evacuation of casualties.

The feasibility of the concept was established and a limited evaluation of the system was conducted on a temperate climate forest during Sept 64. An Engineering Design Test and Category II Military Potential Test of the system was conducted in Hawaii during the period 15 Apr to 15 May 65. Deficiencies noted during the Apr 65 test were corrected and a retest of the prototype system conducted during the period 18 - 22 Nov 65. On completion of retest, the prototype was shipped to Vietnam for field demonstration and evaluation on 29 Nov 65. Information from Vietnam led to redesign of the net dispenser. Five additional systems were shipped to Vietnam. Selected units assigned to U. S. Army Vietnam were trained and demonstrations conducted during the period 15 Sep to 19 Oct 66 by an LWL training team. Due to lack of interest by units trained, ACTIV decided to discontinue the program. Renewed interest from both the 1st Cav and 4th Inf Division directed the employment of this system as soon as possible with the CH-47 (Chinook). The systems in-country were located and shipped to both Divisions.

TASK NUMBER: 12-S-63

TITLE: Packet, Subsistence, Long Range Patrol

AUTHORIZED FUNDING: \$3,891

TASK DURATION: 13 August 1963 to 8 August 1964

DESCRIPTION AND RESULTS: A lightweight food packet, measuring 7" x 3-3/4" x 1-1/2" and weighing 10 ounces which takes only a canteen cup of hot water and 20 minutes (30 minutes with cold water) to prepare a 1,000 calorie meal.

Consisting of components from a six man ration developed by the Armed Forces Food and Container Institute of Chicago, Illinois, the eight menus offer the user a selection of beef hash, spaghetti with meat sauce, chicken stew, beef stew, chili con carne, beef and rice, meat balls with beans and chicken and rice. The ration also includes an accessory packet of a drink and a candy bar or cake

Task completed January 1964. The food packet was tested by Special Forces personnel during SWIFT STRIKE III at Fort Bragg, North Carolina and by the U. S. Army Infantry Board in the Panama Canal Zone during period 23 July - 16 August 1963.

The food packet was type classified as LP in January 1964 with approval for an initial procurement of 300,000 food packets with delivery scheduled for September 1964.

TASK NUMBER: 01-S-64

TITLE: Shelter, Utility, Tropical

AUTHORIZED FUNDING: \$47,382

TASK DURATION: 20 August 1963 to 3 March 1966

DESCRIPTION AND RESULTS: The object of this task was to design and fabricate a lightweight, air-transportable, easily-erected shelter to protect personnel from the heat of the sun, precipitation and insects while performing duties. A prototype shelter was designed and manufactured by contractor. The shelter consists of an inner tent with a 12-foot skirt of insect netting and a tent fly which provides an insulated air space for protection against the heat. The shelter measures 32 feet wide, 25.8 feet long, and 22 feet high. The complete weight of the shelter, including poles, base plates and fabric, is 583 pounds. The shelter can be broken down into 3 major components and can be erected in one hour by 5 men.

Initial tests of the shelter at APG indicated the tent was adequate but the pole structure was inadequate. Redesign and fabrication of the poles was completed in May 1964. Additional testing proved the new pole design adequate to withstand winds in excess of 65 miles per hour.

Two of the prototype models were subjected to Military Potential Tests in Panama and two others were evaluated in South Vietnam. The ACTIV evaluation concluded that the Shelter, Utility, Tropical did not meet the requirement for an air transportable aircraft maintenance shelter in Vietnam and recommended that the development be terminated.

TASK NUMBER: 02-S-64

TITLE: Reduction of Soldier's Load

AUTHORIZED FUNDING: \$5,285

TASK DURATION: 17 October 1963 to 23 November 1964

DESCRIPTION AND RESULTS: An in-house analysis and exploitation of the possibilities for weight-reduction and improved operational effectiveness of all items worn or carried by Special Action Forces. This task was terminated after preliminary studies. However, LWL continued liaison with the U. S. Army Natick Laboratories on an Army-wide program identified as LINCLOE (lightening infantry clothing and equipment). This program encompassed most of the work planned for this LWL task.

TASK NUMBER: 03-S-64

TITLE: Survival Kit (Hot-Dry)

AUTHORIZED FUNDING: \$127,940

TASK DURATION: 18 October 1963 to 19 October 1967

CONTRACTOR: Melpar Inc.

DESCRIPTION AND RESULTS: To design, develop, fabricate and test an individual survival kit for a hot-dry climatic area to conform to an approved SDR. The hot-dry survival kit will consist of approximately fifty different component items for obtaining water, food, protection against physical and disease environment and provision of an escape and evasion capability. The complete kit is expected to weigh less than one and one-half pounds.

A kit was developed consisting of about fifty (50) components packaged in an all-region basic unit and a separate regional unit containing items specifically designed for survival in hot-dry areas. The basic unit includes medicines for diarrhea, dysentery, a pain killer, anti-malarial drugs and a treatment for fungus skin diseases. Non-medical items include signal flares, a signal mirror, insect repellent, a head net and mittens for insect protection, a fire starter and a razor knife. The regional unit contains a head cloth, folding sun glasses, and a booklet on survival in hot-dry areas.

TASK NUMBER: 04-S-64

TITLE: Improved Survival Kit + Plastic Cooking Container

AUTHORIZED FUNDING: \$9,986

TASK DURATION: 17 October 1963 to 25 March 1965

CONTRACTOR: Melpar Inc.

DESCRIPTION AND RESULTS: Based on information from use of the Hot-Wet Survival Kit in the field and from service tests, design and develop an improved hot-wet survival kit to include a plastic cooking container in which water can be boiled. This kit is to be lighter and more compact than the current one. Following in-house investigations this task was terminated and all work incorporated under LWL Task 03-S-64, Individual Aid & Survival Kit (Hot/Dry) and LWL Task 03-S-65, Individual Aid & Survival Kit (Cold Wet/Dry).

TASK NUMBER: 05-S-64

TITLE: Free-Drop Water Container

AUTHORIZED FUNDING: \$40,082

TASK DURATION: 17 October 1963 to 3 February 1966

DESCRIPTION AND RESULTS: Design, develop, fabricate and test a container for water of up to 5 gallon capacity that can successfully be free dropped from altitudes of 50 to 500 feet at air speeds of 0 to 130 knots. It must be fabricated of such materials that would provide the minimum of support to enemy troops in case of recovery by other than friendly forces.

The free-drop water container developed is an eight-inch tube, fifty-two inches long and holds three gallons. The tube is made of eight thicknesses of five mil modified polyurethane material, one inside the other. The external bag is international orange in color. The container is filled with three gallons of water and each tube tied by means of a simple overhand slip knot. The filled bag is then inserted in a corrugated carton 4-1/2 x 5-1/2 x 38 inches. The filled container ready for free drop weighs approximately 27 pounds.

Tests have shown that the survival rate of the containers, when dropped on a soil ground surface is normally 100%. On impact with rocks, the survival rate drops to approximately 95% and when dropped through trees, a survival rate of about 80% was achieved.

Free-drop water container safety statement and medical clearance were completed on 29 December 1965. Twenty-thousand five-hundred units were bought. Procurement responsibility for the AMC requirement was placed with the Procurement Office, Aberdeen Proving Ground with USALWL acting as technical advisor. A contract was signed 22 April 1966 for operational quantities.

TASK NUMBER: 01-S-65

TITLE: CI Mob Control Equipment Studies

AUTHORIZED FUNDING: \$8,022

TASK DURATION: 3 August 1964 to 6 June 1967

DESCRIPTION AND RESULTS: This study task produced a report indicative of potential developments for mob control equipment. In certain cases where items developed for other purposes have application and where principles can be demonstrated with existing lab equipment, "breadboard" hardware were studied. In other cases more concepts are discussed.

One concept is a method of delivery to a one-man target of itching powder, sneezing powder or other material for destroying the leader-image of an agitator or natural mob leader by making him look ludicrous to his followers. Another is adaptation of the LWL developed acoustic telescope and a "bull-horn" to feed back an agitator's voice with a slight time-delay to cause stammering. For controlling movement, anti-fire foam is proposed as also is an anisotropic additive to water that reduces friction to the point that no one can stand up in the wetted area. For psychologically isolating members of the mob, flickering lights at a frequency between 3 cycles per second and flicker fusion is proposed to bring the pupillary reflex into play. This causes discomfort and dazzle with the eyes feeling gritty. All people exposed are affected, concentration becomes difficult and the individual is brought out of identity with the mob and into concern for self. Friendlies can be protected by using gelatine filters for color and wearing appropriate goggles.

TASK NUMBER: 02-S-65

TITLE: Compass - Fog and Fungus Proof

AUTHORIZED FUNDING: \$1,886

TASK DURATION: 3 August 1964 to 3 March 1966

DESCRIPTION AND RESULTS: Develop a hand-held field compass which will be compatible with current and future military maps produced by the Corps of Engineers. The compass is to be readily usable in all climatic areas, and unaffected by moisture, fungus and fogging.

The item developed is a modification of a commercial compass, light-weight (0.75 ozs. as opposed to 4.8 ozs. for the standard issue compass) compact (1-1/2" x 2-1/2" x 1/4" as opposed to 2-1/4" x 3" x 1" for the standard issue compass) and liquid filled with a hermetically sealed capsule. Compasses were sent to the LWL Liaison Officer in RVN for demonstration and eight-hundred seventy-five were procured by AMC with LWL Technical Supervision as a result of a quick-reaction letter. These were used to determine a basis of issue.

B-259

TASK NUMBER: 03-S-65

TITLE: Individual Aid and Survival Kit (Cold-Wet/Dry)

AUTHORIZED FUNDING: \$14,604

TASK DURATION: 3 August 1964 to 19 October 1967

DESCRIPTION AND RESULTS: Design, develop, and test an individual survival kit for cold/wet, and cold/dry areas, which conforms to an approved SDR. Because of extensive over-lapping of the needs and available resources within the areas, it was determined that a single survival kit designed for both cold-wet and cold-dry regions would be adequate for individuals in a survival status. Accordingly, LWL Task 04-S-65, Individual Aid & Survival Kit (Cold/Dry) was incorporated into LWL Task 03-S-65, whose title was changed from Individual Aid & Survival Kit (Cold/Wet) to the above title.

LWL developed a kit consisting of about 50 components packaged in an all-region basic unit and a separate regional unit containing items specifically designed for survival in cold-wet/dry areas. The basic unit includes medicines for diarrhea, dysentery, a pain killer, anti-malarial drugs and a treatment for fungus skin diseases. Non-medical items include signal flares, a signal mirror, insect repellent, a head net and mittens for insect protection, a fire starter and a razor knife. The regional unit contains a snow melting tube, a sleeping bag shell to be filled with available moss, grass, leaves, etc., folding sun glasses and a survival booklet for cold-wet/dry areas. Survival kits were service tested by the U. S. Army Arctic Test Center and were found to have several deficiencies. The Surgeon General was the designated parent agency for this task.

TASK NUMBER: 01-S-66

TITLE: Tent, Medical Treatment, Special Forces

AUTHORIZED FUNDING: \$28,110

TASK DURATION: 10 March 1966 to 5 August 1968

DESCRIPTION AND RESULTS: This item is a lightweight tent supported on a tensioned structure principle. The frame comprises sectioned aluminum rods (joined by Bungee-Cord) and fiberglass rods. The shape is reminiscent of a Conestoga Wagon. The tent body and integral floor are made from a neoprene coated nylon. Doors are provided at both ends of the structure; ventilation panels are provided with mosquito-netting proofed windows. The design allows two or more tents to be joined end to end.

The tent has a floor area of 115" x 140" with a minimum head room of 72"; 84" at the peak. It weighs 32 pounds total when packed for carrying on a rucksack frame. One man can erect the tent in ten minutes and it can be struck in a similar time. No special hand tools, other than a mallet, are required for the erection. Field life expectancy is a minimum of 180 days.

In-house testing was conducted in hot-dry and warm-wet climatic conditions. The lower limits of the intermediate climatic conditions necessitate auxiliary heating and a liner. Two tents were available for evaluation and demonstration. NLABS is the designated parent agency (TSG has attendant responsibility) for this task.

B-261

TASK NUMBER: 02-S-66

TITLE: Ventilated Flight Suit

AUTHORIZED FUNDING: \$15,215

TASK DURATION: 1 October 1965 to 11 July 1966

DESCRIPTION AND RESULTS: Each system consists of a blower connected by flexible hoses to the ram air inlet in the nose of the aircraft and to two ventilated flight suits to be worn by the pilot and co-pilot. The hoses connect to the ventilated flight suits by a quick-disconnect attachment. The blower forces 18 cu. feet of air per minute into the suits. If air is not needed for cooling, the ram air inlet can be closed and the blower can be shut off entirely.

In use, ambient air is pulled by the blower through the ram air inlet in the nose of the aircraft and delivered through flexible tubes to the air distributor where it spreads over the body of the wearer. Cooling is accomplished by evaporation of the wearer's perspiration.

Five systems consisting of ten suits, necessary flexible hoses and five blowers were received in Vietnam on 7 March 1966 for evaluation.

B-262

TASK NUMBER: 01-S-67

TITLE: Lightweight, Four Man, Fabric Boat

AUTHORIZED FUNDING: \$27,032

TASK DURATION: 4 August 1966 to 1 August 1968

DESCRIPTION AND RESULTS: A lightweight (six pounds), four-man, fabric boat was constructed of nylon with flotation bladders (breath inflatable) of vinyl. The boat is a wholly tensioned structure; only the air in the bladders was in compression. Two men can readily inflate the boat in less than six minutes. The boat measures 8'10" x 3'0" and easily supports four persons. There is ample buoyancy for loads of 1,300 pounds.

Eighteen boats were evaluated in Vietnam. These were shipped on 21 Mar 68. Improvements in bladder material were investigated with a view to reduce rustling noises and improve bladder life and strength. USAMEC/USAMERDC was the designated parent agency for this task.

TASK NUMBER: 02-S-67

TITLE: Tunnel Security and Intelligence Team Protective Equipment

AUTHORIZED FUNDING: \$71,218

TASK DURATION: 24 August 1966 to 19 January 1968

DESCRIPTION AND RESULTS: The kit consists of communication equipment, a waterproof flashlight, a .22 caliber pistol and holster, ear plugs and a double-edged knife for protection and probing for mines and booby traps. Compact oxygen breathing apparatus were investigated as a possible kit inclusion, based on tentative requirement for RVN. Two different type commercial units were tested and evaluated at Dugway Proving Ground. These items were subsequently dropped from the kit when it was determined that no requirement existed in RVN.

Components for six tunnel exploration kits were assembled for shipment to RVN. Prior to shipment, ENSURE 64 was received requesting 454 operational kits for RVN. The U. S. Army Natick Laboratories were designated as the responsible parent agency for the ENSURE and, subsequently, prototype kits with supporting information and data were turned over to NLABS. The tunnel exploration kits were shipped to Vietnam by the USA Natick Laboratories in May 1968.

TASK NUMBER: 03-5-57

TITLE: Fire Starter, Waterproof

AUTHORIZED FUNDING: \$12,191

TASK DURATION: 4 August 1966 to 30 June 1967

DESCRIPTION AND RESULTS: A "fire stick" composed of magnesium and mischmetal (a mixture of rare earth elements in metallic form - cesium, lanthanum and neodymium) has been decided upon. It is a cylindrical metal rod 2-1/3" long and 1/4" in diameter. The "fire stick" will operate reliably after exposure to extremes of heat, cold and moisture. Developed is a shaver-sparker to remove filings and small metal particles from the "fire stick" to facilitate starting the fire.

Thirty-six fire starters were shipped to RVN on or about 27 Dec 67 for test and evaluation by ACTIV (ENSURE 228). Message received 18 May 68 from CG, USARV, stated that the items were received and used in operations in RVN. No further requirements for the fire starter were envisioned. NLABS was the designated parent agency for this task.

B-265

TASK NUMBER: 04-S-67

TITLE: Survival Kit, State of the Art Review

AUTHORIZED FUNDING: \$5,110

TASK DURATION: 4 August 1966 to 19 October 1968

DESCRIPTION AND RESULTS: This was a study to determine the status of survival kit development. This study included a review of the adequacy of the kits and survival information then issued or to be issued by the various U. S. Government departments and those of foreign nations. In addition, an evaluation was made of the separate components of each kit, packaging and acceptance by the individual user.

B-266

TASK NUMBER: 05-S-67

TITLE: Cache Container Inserts for M4A Aerial Delivery Container

AUTHORIZED FUNDING: \$18,810

TASK DURATION: 2 February 1967 to 2 August 1968

DESCRIPTION AND RESULTS: The container inserts are made of a tough, rigid impact resistant Acrylonitrile Butadiene-Styrene plastic. The insert consists of two pieces, a base and slip-over top, and is approximately 20" in diameter when assembled. The inserts, which are extendable to accommodate various sized packages, have a minimum length of approximately 15" and an extended length of approximately 20". In addition, three different continuous ring seal designs were developed to effect a watertight circumferential seal of the insert halves. The insert will house and protect containers as well as provide a means for carrying items away from drop zone and will serve as a waterproof storage container which can be used to cache supplies for future use.

Six inserts and the three candidate circumferential seals were shipped to RVN in March 1968 for evaluation. Although the test indicated that the inserts meet the specifications cited in the ENSURE Requirement and one of the seals failed during the tests, USARV stated that there was no longer a requirement for the inserts. Accordingly, the procurement action for the total ENSURE quantity of 300 inserts was terminated, DA listed ENSURE 173 as a completed action and the CONUS Military Potential Test of the inserts was cancelled.

TASK NUMBER: 06-S-67

TITLE: Trail Cutting Machete

AUTHORIZED FUNDING: \$32,029

TASK DURATION: 20 February 1967 to 12 March 1968

DESCRIPTION AND RESULTS: The machete has an overall length of 18-1/2 inches and weighs approximately one pound. It has a specially shaped handle that will not blister the palm in use. The blade is 13-1/2 inches long; 9 inches of which is sharpened. The narrow throat near the handle is not sharpened. For digging purposes, the end is square and also sharpened. The surface of the blade is unpolished to prevent sticking in greenwood; eliminating light reflections, and minimizing rusting. The scabbard is fabricated from a durable plastic, olive green in color. A small pocket in the scabbard holds a sharpener of stainless steel flame coated with Tungsten Carbide.

One hundred fifty machetes, scabbards and machete sharpeners were shipped to Vietnam on 15 Feb 68 for test and evaluation. The machete was evaluated and proved to be superior to present one. However, procurement was not recommended. U. S. Army Natick Laboratories was the designated parent agency for this task.

TASK NUMBER: 07-S-67

TITLE: Flotation Gear for Individual Soldiers

AUTHORIZED FUNDING: \$13,956

TASK DURATION: 14 April 1967 to 7 March 1968

DESCRIPTION AND RESULTS: The flotation gear, designed to support a fully armed and equipped soldier, contains three individual bladders comprising a total volume of 1.11 cubic feet. The bladders, which are three mil vinyl, are inclosed in a one piece, compartmented 3/4 ounce nylon ripstop material which, after inflation, forms a "U" shape around the body. The flotation gear, which weighs 8 ounces, is packed in a pouch which is attached to the flotation gear. The pouch measures 2"x4"x6" high and contains an instruction sheet and a spare bladder.

In addition to providing adequate buoyancy to support a man carrying 60 pounds of equipment, several flotation gear can be tied together to form a raft. The flotation gear can also be tied to a litter for floating wounded across streams or any type of hardware requiring buoyancy.

Two hundred flotation gear were shipped to Vietnam for evaluation on 21 Mar 68. USAMEC/USAMERDC was the designated parent agency for this task.

TASK NUMBER: 08-S-67

TITLE: Knife, Demolition

AUTHORIZED FUNDING: \$26,426

TASK DURATION: 12 May 1967 to 19 August 1968

DESCRIPTION AND RESULTS: This knife is lightweight, compact, and has the following components: four and one-half inch blade, two screwdrivers, sized for screws in the galvanometer, centimeter scale for measuring fuze and charges, demolition cap crimper, wire and fuze cutter, demolition cap setter, and wire skinner. Beryllium copper is used in functional areas which preclude the possibility of a "spark" when setting up demolition charges. Two hundred demolition knives were fabricated for CONUS evaluation and one hundred fifty for shipment to RVN for evaluation.

B-270

TASK NUMBER: 01-S-68

TITLE: Refugee Kit for Troop Commanders

AUTHORIZED FUNDING: \$2,543

TASK DURATION: 9 August 1967 to 11 April 1968

DESCRIPTION AND RESULTS: A refugee kit was designed for issue by troop commanders to refugees of military actions. The kit was designed to sustain an average Vietnamese family of five persons for twenty-four hours.

The refugee kit is packaged in a cardboard box which also contains an aluminum cooking pot. Sufficient fuel is provided in the kit to cook all of the contents and to heat water to prepare soup and tea. The package weighs 14 pounds and measures 10-³/₄" x 7-¹/₄" x 10-¹/₈" deep. The total number of available kilocalories in the kit is 14,107.

Fifty refugee kits were evaluated in Vietnam; these were shipped 31 Mar 68. The U. S. Army Natick Laboratories was the designated parent agency for this task.

TASK NUMBER: 02-S-68

TITLE: Disposable Airdrop Container

AUTHORIZED FUNDING: \$177,185

TASK DURATION: 9 August 1967 to 22 November 1971

DESCRIPTION AND RESULTS: The disposable container was developed to provide a means of delivering supplies to long range patrols or clandestine units. The container is made of filament wound glass fiber with an acrylic resin which permits easy disposition by burning during clandestine operations. Under other operational conditions, it can be recovered and reused. The container is approximately 110 in. long and 21 in. in diameter. It is aerodynamically shaped for delivery by high performance aircraft at 300 ft altitude and at speeds up to 500 knots. The container including its parachute and explosive thruster weighs 140 lbs and it is designed to deliver a payload of up to 500 lbs.

Certification tests for the prototype container were conducted on F-4 and A-4 aircraft by the U. S. Naval Air Test Center under a cooperative agreement between the U. S. Army Land Warfare Laboratory, the Marines, and the Navy. As certified, the filament wound fiber glass container is satisfactory for carriage and release to the limits now established for the Navy CTU-1/A Container. Information packages were provided to the designated Parent Agency (U. S. Army Natick Laboratories) and to the Marines.

TASK NUMBER: 03-S-68

TITLE: Table-Top Sound Booth

AUTHORIZED FUNDING: \$5,294

TASK DURATION: 11 August 1967 to 19 February 1968

DESCRIPTION AND RESULTS: Two prototypes were fabricated from a waterproof, sound absorbent material, designed to be placed on a field table and accommodate two persons for interrogation purposes. Acoustically, both prototypes were acceptable. However, the design was considered unacceptable from the standpoint of stress psychology and heat exchange in the environment of SVN.

B-273

TASK NUMBER: 04-S-68

TITLE: Small Roll-Press

AUTHORIZED FUNDING: \$14,141

TASK DURATION: 11 August 1967 to 12 December 1968

DESCRIPTION AND RESULTS: The Small-Roll Press is a small, hand-operated unit employing the lithography principle. The press has a cutting and stacking feature and uses 5-1/2" wide roll paper. The capability of using sheet paper and an automatic feed system can be provided if desired. The system produces copies of good quality and clarity in an appropriate quantity to exploit local issues in a timely manner. The rate of production is approximately 4,000 copies per hour. The weight of this system (dry) is 20 pounds. It is a mobile unit capable of being dismantled in a minimum amount of time without the requirement of special handling and is easily transportable by available transportation facilities. The unit is capable of producing copies from handwritten, printed or typed material. Seven presses with paper and accessories were shipped to RVN during October and November 1968 for evaluation.

TASK NUMBER: 05-S-68

TITLE: Individual Escape and Evasion Kit

AUTHORIZED FUNDING: \$19,506

TASK DURATION: 29 August 1967 to 1 June 1970

DESCRIPTION AND RESULTS: The Individual Escape and Evasion Kits were tested and evaluated in CONUS and the results published in Technical Note No. 70-02, entitled "Individual Escape and Evasion Kit," classified SECRET. The U.S. Air Force Special Operations Plan and Policy Branch of the Office of the U.S. Air Force Assistant Chief of Staff for Plans was assigned as the Parent Agency for the USALWL Individual Escape and Evasion Kit. The kits can be purchased through this agency.

B-275

TASK NUMBER: 06-S-68

TITLE: CONEX Containers - Humidity Control

AUTHORIZED FUNDING: \$1,529

TASK DURATION: 27 March 1968 to 20 May 1968

DESCRIPTION AND RESULTS: A final letter report was forwarded to DA on this program to investigate the feasibility of providing a system or method to remove moisture and control humidity within containers and obtain information on dehumidification tests and evaluation of systems or methods tried in the past and their results. DA decided that nothing further would be done.

TASK NUMBER: 01-S-69

TITLE: New Individual Aid and Survival Kit (Cold/Wet Dry)

AUTHORIZED FUNDING: \$13,325

TASK DURATION: 7 August 1968 to 8 May 1970

DESCRIPTION AND RESULTS: The kit has a medical, utility and operational capability. The medical component comprises a set of drugs (includes treatment for diarrhea and various infections, antimalarial drugs and a pain killer, etc.) contained in a sealed plastic wallet. The medical wallet is sealed as a separate package so that the use of the drugs can be controlled at the point of issue. The carrier is designed with two pockets; one contains the medical and utility components, which are common to all survival kits, the other pocket contains the operational components necessary for the particular environment. The carrier has been designed to enable the user to cut away one pocket as survival items are used to a point where only one pocket is necessary.

A Service Test by USATECOM on the New Individual Aid and Survival Kit (Cold-Wet/Dry) was completed. TSG and Natick Laboratories were the designated parent agencies for this project, and received a complete technical data package.

B-277

TASK NUMBER: 02-S-69

TITLE: Portable Interrogation Booth

AUTHORIZED FUNDING: \$17,745

TASK DURATION: 14 August 1968 to 26 November 1969

DESCRIPTION AND RESULTS: The Portable Interrogation Booth consists of an enclosure and communications equipment including a cassette recorder. The enclosure is a lightweight, tubular, adjustable frame with a writing shelf and a lightweight curtain suspended from the top of the frame. The communications equipment consists of sound powered headsets with noise shielded microphones, and a cassette tape recorder. An electrical interconnection box is provided to accommodate any combination of sound powered headsets and tape recorders up to six.

The task was cancelled because the evaluating groups indicated no requirement and no need for the equipment. There were, however, favorable comments for the communications package and recommendations to continue development of it for use in front line PSYOPS. The equipment was evaluated by various Government agencies.

TASK NUMBER: 03-S-69

TITLE: Chemical and Physical Barriers for Crowd and Riot Control

TASK DURATION: 14 August 1968 to 8 January 1969

DESCRIPTION AND RESULTS: A study was conducted to determine suitable barriers either of a chemical or physical type to replace the heavy and cumbersome ones now used.

This task was cancelled in January 1969. Discussions with various military and civil police authorities, and a background study suggested there were several disadvantages to the use of chemical substances (other than CS, Orthochlorbenzalmalononitrile) in attempting to "barricade" areas against crowds. There are no lightweight, robust substitutes for the current practice of poles, trestles, wire and water filled forty-five gallon drums that were acceptable to USACDCMPA.

TASK NUMBER: 04-S-69

TITLE: Delivery of Anti-Riot Agents

AUTHORIZED FUNDING: \$25,093

TASK DURATION: 14 August 1968 to 29 September 1969

DESCRIPTION AND RESULTS: A 12-gauge round was developed commercially, for flushing out snipers, arsonists, etc., from buildings. The round, fired from a conventional 12-gauge, open bore (unchocked) shotgun, is formed from injection molded plastic and has a capacity of 2.5 cc. One 12-gauge round, loaded with a riot control agent (CS), will effectively incapacitate persons barricaded in a room measuring 9' x 12' x 9' high. The round has an initial muzzle velocity of 1,000 feet per second and will penetrate a 1/4 inch thick plate glass at 100 yards range. Its accuracy is sufficient to obtain a two foot radial group at 100 yards. Attempts were made to modify the round, as an antipersonnel round, but proved unsuccessful. Results of the tests did indicate that a low velocity round could be developed and that R&D in this area should be continued.

The 12-gauge round was tested by both USALWL and USATECOM. A USALWL Technical Report No. 69-17, entitled "Delivery of Anti-Riot Agents", AD 860 545L, was written which includes the USATECOM final report. U.S. Army Edgewood Arsenal was the designated parent agency, and received the complete technical data package.

TASK NUMBER: 05-S-69

TITLE: Improved Packaging of Water Purification Tablet

AUTHORIZED FUNDING: \$157,977

TASK DURATION: 22 August 1968 to 27 February 1974

CONTRACTOR: Columbia Research Corporation

DESCRIPTION AND RESULTS: The iodine water purification tablets are individually sealed in blister sheets. The blister sheet, measuring approximately 1-3/4" x 2-1/8", contains 12 blister units. The blister units are transparent so that the color of the contained iodine tablet may be observed. The color of the potent, fully effective iodine tablet is steel gray. Since a change in color indicates a loss of potency, a steel gray color match background is provided as a means of determining if the iodine tablets are fully effective. Tablets which are not fully effective can be discarded. A "V" shaped tear notch is provided on the edges of the blister sheet opposite each iodine tablet to obtain the tablet. Two blister sheets, each containing 12 tablets individually sealed, are sealed in an over-wrapper cover. Two "V" tear notches, one on each side near the one end of the packet, are provided to facilitate easy opening of the packet. The new, simplified directions for use are printed on the back of each blister sheet and on one side of the over-wrapper cover. Manufacture information is printed on the other side of the over-wrapper cover.

TASK NUMBER: 06-S-69

TITLE: Low Cost Solar Still

AUTHORIZED FUNDING: \$10,534

TASK DURATION: 9 October 1968 to 8 January 1971

DESCRIPTION AND RESULTS: The still consists of a simple insulated, one by two meter framework, enveloped in plastic film, and containing a wick-evaporator. The still is oriented normal to the plane defined by the solar arc (i.e., the apparent path of the sun from sunup to sundown). Adjacent to the still, and oriented the same way, is a solar water heater to pre-heat the input water to increase the efficiency of the evaporator. The plastic film acts as a condenser. The condensed water flows as a capillary film to a collector. The wick-evaporator is continuously flushed so that no residue of salts accumulates.

An initial prototype was made and tested using cheap construction vapor barrier polyethylene as the condenser, a wooden frame, a black knitted nylon fabric as the wick, and rice husks as insulation. The insulation was so effective that the condensing film sagged into contact with the evaporator due to the high temperatures reached.

A redesigned still was made using a polyester film condenser to overcome the sagging, and a solar water heater was added. Evaluation quantities plus instructions, engineering drawings, and a bill of materials were made. Instructional material in Vietnamese was made available.

TASK NUMBER: 07-S-69

TITLE: Improved Survival Kit, Hot-Dry

AUTHORIZED FUNDING: \$7,625

TASK DURATION: 8 November 1968 to 26 June 1970

DESCRIPTION AND RESULTS: The development of this kit was concurrent with the development of the "New Individual Aid and Survival Kit (Cold-Wet/Dry)" (01-S-69). The basic contents and packaging of both kits are similar. The only variation in the kit contents is the adding of one package of salt in lieu of the lip salve in the Cold-Wet/Dry Kit. TSG and Natick Laboratories were the designated parent agencies, and received complete technical data packages.

TASK NUMBER: 08-S-69

TITLE: Inundated Area Position Markers

AUTHORIZED FUNDING: \$49,268

TASK DURATION: 6 December 1968 to 18 January 1971

DESCRIPTION AND RESULTS: The markers are spherical-shape, 30-inch diameter blaze orange balloons made of polyurethane for toughness. Each balloon is equipped with a tether for anchoring. A one and one-half volt light is provided for illuminating the sphere from the inside. It is operated by a water activated battery capable of 12 hours service. Taking the battery out of the water will deactivate it so that the battery, light and whole system can be reused. The balloons can be seen at a distance of two miles from 500 feet altitude.

The task was terminated. As a result of troop drawdown in RVN, this item lost its priority for evaluation and possible use by U.S. troops. Technical problems were also encountered in meeting the weight requirements. The use of lightweight plastics in fabrication resulted in an unacceptable puncture rate for the balloons.

B-284

TASK NUMBER: 09-S-69

TITLE: Equipment for Aerial Supply of Hot Food

AUTHORIZED FUNDING: \$1,610

TASK DURATION: 9 January 1969 to 19 May 1969

DESCRIPTION AND RESULTS: The task was cancelled three months after approval and before equipment design because inquiries in Vietnam failed to reveal a firm requirement for equipment for air dropped supply of hot food. Background information as to approach, materials and manufacturing methods was obtained.

TASK NUMBER: 10-S-69

TITLE: Evaluation of Proposed U. S. Marine Mini Tents

AUTHORIZED FUNDING: \$3,323

TASK DURATION: 13 June 1969 to 5 September 1969

DESCRIPTION AND RESULTS: The US Marine Corps Mini Tents come in three sizes: Size I, Individual Tent, 84" x 42" x 42" high; Size C, Command Post Tent, 66" x 66" x 48" high; and Size B, Battalion Staff Tent, 84" x 66" x 48" high. The tent consists of a one piece, inflated frame which is secured to the outside waterproof covering by snap fasteners. The tent is breath inflated through an inflation valve located on the frame of the structure to the right side of each door. The door openings on each end are provided with both a screen and a fabric door. The screen or fabric door is secured to the tent with Velcro. The tent is free-standing and provides the user with a ground cloth which prevents the entering of insects and rodents.

An evaluation by USALWL on the US Marine Corps Mini Tents was conducted at Aberdeen Proving Ground, Maryland. Results of the tests were disappointing and USALWL recommended against further evaluation by USARV.

B-286

TASK NUMBER: 01-S-70

TITLE: Lightweight, Hand Operated, Brackish Water Purifier

AUTHORIZED FUNDING: \$178,339

TASK DURATION: 8 August 1969 to 26 February 1974

CONTRACTOR: Philco Ford Corporation

DESCRIPTION AND RESULTS: The prototype purifier developed had overall dimensions of approximately 7-1/2" x 11" x 4". The pump handle was detachable and stored inside the container. There was no exterior plumbing. The unit had an accumulator thereby conserving pressure energy and eliminating pressure fluctuations. Operating pressure was 600 psig when operating at a stroke per second; it had a power requirement of approximately 0.05 hp. Depending on the pumping rate, the water purification rate was one pint of water in one to three minutes. The prototype pump system was developed, including a reverse osmosis membrane module and housing, and was tested in July 1972.

TASK NUMBER: 02-S-70

TITLE: Junk-Sail Windmill Data Package

AUTHORIZED FUNDING: \$8,763

TASK DURATION: 12 August 1969 to 8 January 1971

DESCRIPTION AND RESULTS: The end product of this task was engineering drawings, photographs and instructions for fabricating a junk-sail driven rotor type windmill that can be used to pump water, grind flour, pulverize broken pottery to make grog for stabilizing clay for ceramics and anything else shaft horsepower is useful for. The windmill has eight masts each with a sail of the type used by Vietnamese coastal vessels made of woven matting. The device makes use of skills already available in-country, uses locally available materials, reduces manpower requirements on peasants farmholds, provides opportunities for small businesses and supports Vietnamization of the war.

One hundred copies of the data package were made available 30 Jun 70 for shipment to RVN for use in unit Civic Action programs and for training of RD Cadres at Vung Tau. Copies were distributed to the U.S. Army John F. Kennedy Center for Military Assistance and to USAID for application in other countries where conditions are appropriate.

TASK NUMBER: 03-S-70

TITLE: Rope Kit, Special Purpose Mountaineering and River Crossing

AUTHORIZED FUNDING: \$45,593

TASK DURATION: 18 August 1969 to 27 February 1974

DESCRIPTION AND RESULTS: This item was developed, to provide in kit form, the ropes and equipment required for moving a small unit across a stream and over limited obstacles. As the development work progressed, the value of a general purpose kit to provide a mountain climbing capability also was recognized and was reflected in the final design. The equipment consists of a kit containing 2 ropes 120 ft long, 7/16 in. in diameter, 15 ropes 12 ft long, 1/4 in. in diameter, 1 rope 120 ft long, 1/4 in. in diameter and 15 snap links to facilitate movement of personnel and equipment across rivers and over mountainous terrain. The specific gravity of the rope is such that it will float if dropped in water. The material from which the rope is fabricated, braided polypropylene core and braided nylon cover, is nonabsorbent, therefore, the rope will only increase slightly in weight when wet and will dry quickly.

A test quantity of the kits was fabricated and delivered to RVN, Europe, and Alaska as well as CONUS units for user evaluation in 1st Qtr, FY73.

TASK NUMBER: 04-S-70

TITLE: Improved Ration Heater and Fuel Tablet

AUTHORIZED FUNDING: \$21,305

TASK DURATION: 18 August 1969 to 22 January 1971

DESCRIPTION AND RESULTS: Under this task, fuel tablets made of acetal resin were developed. The heating units weigh one ounce and produce the same amount of heat as the standard Trioxane tablet. The tablets are disk shaped 2-5/8" in diameter by 5/32" thick. The disks have slots cut across the radius which permit two to be joined in a configuration having an X cross section in order to provide the maximum surface for rapid combustion. Two tablets comprise a heating unit. The heating unit contains enough fuel to heat approximately one pint of water from room temperature to the boiling point in approximately seven minutes. The heating units can be used in the B-1A ration can in which holes have been punched in the side. Evaluation quantities of 12,000 tablets and 600 heating grids were provided to troop units in Korea and the information package was turned over to the Parent Agency (U.S. Army Natick Laboratories).

TASK NUMBER: 05-S-70

TITLE: Lightweight Flotation Gear for Individual Soldiers With Semi-Automatic Inflation Device

AUTHORIZED FUNDING: \$71,341

TASK DURATION: 19 September 1969 to 10 February 1972

CONTRACTOR: The Franklin Institute Research Laboratory

DESCRIPTION AND RESULTS: The USALWL flotation device, designed to support a fully equipped combat soldier, consists of three bladders which, after inflation, position themselves under each arm and directly under the user's chin. The gear will automatically inflate when submerged in two feet of water and can be manually inflated with CO₂ or breath inflated. The flotation gear was designed to keep the user in a vertical position. The device weighs two lbs, can be repackaged and recharged in the field without the use of tools and will support an individual carrying 60 lbs of gear. The manifold system incorporates two-way check valves which precludes the possibility of the device failing in the event one or two bladders are damaged. The flotation device is compatible with the Army standard rucksack frame, combat gear and parachute harness, and can also be used simply as a life preserver.

The flotation device was evaluated by RVN troops. Several devices were also shipped to U. S. Army Alaska for evaluation during the summer of 1972. As a result of a letter dated 9 Mar 72 from the Office of the Chief of Engineers, Department of the Army, to the U. S. Army Combat Developments Command, Fort Belvoir, VA, an MN was being initiated to consider adoption of the device for personnel safety use by the U. S. Army Engineer troops. The data package was turned over to the U. S. Army Natick Laboratories, designated Parent Agency for the flotation device.

TASK NUMBER: 02-S-71

TITLE: Shelter, Lightweight, Small Group (4-6 Man)

AUTHORIZED FUNDING: \$35,367

TASK DURATION: 8 July 1970 to 5 November 1973

DESCRIPTION AND RESULTS: The 4-6 Man Tent is supported by a lightweight structure of sectioned aluminum poles and fiber glass rods, has an integrated floor and can be erected by one man within six minutes. The design, similar to a Conestoga Wagon, weighs 32 pounds, has an unobstructed floor area of 10 x 12 feet and a minimum head room of 6 feet along the tent walls, and 8 feet at the peak. Doors and ventilation panels are provided at both ends of the structure and a stovepipe outlet for installing the Yukon stove has been provided. The basic tent offers two environmental accessory kits; a frost liner for the cold-wet/dry environments and a sunshade for the hot-wet/dry environments. The tent can be backpacked on standard Army rucksack frames.

Two 4-6 Man Tents were evaluated in the desert and tropic environments and two additional tents were evaluated in Alaska during the winter of 1973-74. The complete data package was turned over to the U. S. Army Natick Laboratories, the designated Parent Agency.

TASK NUMBER: 03-S-71

TITLE: Tent, Two-Man, General Purpose

AUTHORIZED FUNDING: \$45,333

TASK DURATION: 15 July 1970 to 4 June 1973

DESCRIPTION AND RESULTS: A two-man, freestanding, 7 pound tent was developed. The tent has a built-in ground cloth and can be erected by one man within two minutes. The tent frame, which is integrated within the basic fabric, precludes the possibility of losing or misplacing components. The packaged configuration measures 13 inches long and 6 inches in diameter. A sunshade and/or liner is available for extreme temperature conditions.

The tents were evaluated at the U. S. Army Arctic Test Center in Alaska and at the Tropic Test Center in Panama. Desert tests were also conducted. The complete data package was turned over to the U. S. Army Natick Laboratories, the designated Parent Agency.

TASK NUMBER: 04-S-71

TITLE: Survival Kit Components to Meet Currently Unfilled Requirements

AUTHORIZED FUNDING: \$15,956

TASK DURATION: 22 July 1970 to 14 January 1972

DESCRIPTION AND RESULTS: Two types of packets containing material for converting nonpotable brackish water to potable water were developed to be used in the individual survival kit. One type of packet contains 9 grams of precipitation material and the other contains 25 grams of mixed-bed ion exchange resins. A bag is provided and the contents of the packets are dumped into the bag of nonpotable water and shaken. The bag of water will be cloth filtered (shirt, handkerchief) into a canteen. Both are designed to purify one quart of nonpotable water.

The two types of packets tested show promise, yet required additional study to permit a selection to be made. A follow-on task was proposed for FY73 (02-S-73).

B-294

TASK NUMBER: 05-S-71

TITLE: Bunker/Tent Heater

AUTHORIZED FUNDING: \$16,046

TASK DURATION: 24 July 1970 to 4 August 1972

DESCRIPTION AND RESULTS: The feasibility of developing a new fuel burner and stove was investigated. Burner features considered included multifuel capability, liquid fuel preheat (to improve combustion efficiency), optimum heat transfer, safety features, positive fuel feed control and methods of preventing freeze-up of fuel lines.

It was determined that prototypes of a new stove should be fabricated. Work was continued under Task 04-S-73.

TASK NUMBER: 06-S-71

TITLE: Methods for Obtaining Water in Cold Environments

AUTHORIZED FUNDING: \$35,004

TASK DURATION: 31 July 1970 to 29 March 1974

DESCRIPTION AND RESULTS: This item is a two quart flexible canteen designed for arctic use so that the user can have liquid water with him at all times regardless of the temperature. The canteen is constructed of a plastic material that will withstand extremely cold weather without cracking. It is designed to be worn near the body like a vest under the outer garments. There is an extension on the canteen with an opening large enough to insert ice and snow without removing the outer garments. A flexible sip tube is connected to the canteen to allow the soldier to drink while on the move without removing the canteen from beneath his clothing.

TASK NUMBER: 07-S-71

TITLE: Components for Strategic Operations Patrol Rations/Packets

AUTHORIZED FUNDING: \$80,284

TASK DURATION: 26 August 1970 to 11 December 1972

DESCRIPTION AND RESULTS: The reversibly compressed food components are about one-fourth as bulky as the food components currently included in the long range patrol food packets. The food components, measuring approximately 3-1/8" x 1-1/8" x 5/8" and weighing approximately 1.1 ounces, may be rehydrated in cold or hot water or eaten dry. The food components are packaged in flexible, durable, waterproof packets consistent with the needs of a seven-day patrol mission. A rehydration bag is included in the package. Further technical development of this item was conducted at U. S. Army Natick Laboratories.

B-297

TASK NUMBER: 08-S-71

TITLE: Emergency Repair Shelter for the CH-47 Helicopter

AUTHORIZED FUNDING: \$34,456

TASK DURATION: 10 September 1970 to 1 February 1973

DESCRIPTION AND RESULTS: Repair of the CH47 Helicopter in the field under an arctic environment is difficult and many times impossible due to a combination of low temperatures and high winds. Two collapsible shelters were fabricated to cover either engine nacelle and the aperture of the loading ramp area when it is open; it is in these areas that the majority of emergency repairs occurs. The shelters are lightweight, they are designed to be heated with the Herman Nelson heater and can be installed by trained personnel within 20 minutes.

Field testing was conducted by the U. S. Army Arctic Test Center in Alaska and the data package was turned over to the U. S. Army Natick Laboratories who were designated the Parent Agency.

TASK NUMBER: 09-S-71

TITLE: Automatic Personnel Verifier

AUTHORIZED FUNDING: \$26,110

TASK DURATION: 9 March 1971 to 27 October 1972

DESCRIPTION AND RESULTS: Security of missile sites and other sensitive areas requires a rapid, positive means of personnel identification. The Automatic Personnel Verifier shows promise as a means of providing this capability. The Automatic Personnel Verifier is essentially an optical computer which can compare in real-time the peculiar and unique identification characteristics of a fresh fingerprint with a previously prepared ID card (either carried by a person or stored in the machine) upon which the person's same fingerprint has been optically encoded in scrambled form on a suitable photographic transparent film clip. The correlation of the fresh fingerprint with the ID card film clip information activates a signal to signify that a match has taken place and the true identity of the person utilizing the device has been confirmed. This signal can be converted to any indication required; it typically operates a solenoid to unlock a door.

Statistical analysis of test data confirmed that the system provides a highly sensitive and selective means for identification. It has an extremely low probability of accepting false combinations of fingerprints and identification cards. The system performed with high reliability. Additional development of means for simplifying the fingerprint insertion process by users is indicated.

B-299

TASK NUMBER: 02-S-72

TITLE: Portable Sign-Making Kit

AUTHORIZED FUNDING: \$21,603

TASK DURATION: 9 August 1971 to 31 December 1972

DESCRIPTION AND RESULTS: A sign-making kit containing sufficient components to fabricate approximately 100 signs was developed for use by Military Police Units. The kit is packaged in a fiber glass carrying case which contains all the necessary materials to cut, shape and erect signs. Inexpensive, attractive signs can readily be fabricated by the use of self-adhesive vinyl lettering. A quick spray-on type lettering set is also included in the kit. The backing material, which is used to fabricate the sign, is rigid enough to withstand winds of 25 mph. Sign kits were evaluated by various Military Police Agencies throughout the world. Results of the field evaluation, USALWL's recommendations and the complete data package were turned over to the Parent Agency.

B-300

TASK NUMBER: 03-S-72

TITLE: All-Environment Survival Kit

AUTHORIZED FUNDING: \$32,154

TASK DURATION: 9 August 1971 to 8 January 1973

DESCRIPTION AND RESULTS: The survival kit developed by the U. S. Army Land Warfare Laboratory can be used in all environments. The kit contains thirty items, in addition to a carrying case and strap, a map case and survival booklets which contain instructions for environmental survival and protection. The kit is packaged in an aluminum container measuring 6 1/2" x 4" x 2 1/2" which can also be utilized as a cooking pot. The carrying case, a two-pouch configuration, is used to carry the aluminum box in one pouch while the other pouch is utilized for items which may be required for immediate use in addition to local items included at the discretion of the Commanding Officer. The kit can be attached to the pistol belt, carried over the shoulder using the carrying strap or carried in the combat pack.

Survival kit testing and evaluation at the U. S. Army Arctic Test Center and at the U. S. Army Tropic Test Center were completed. An IPR was held at the U. S. Army Land Warfare Laboratory, and type classification of the survival kit was recommended.

B-301

TASK NUMBER: 05-S-72

TITLE: Lightweight, Compact, Snow Shovel and Ice Breaker

AUTHORIZED FUNDING: \$19,126

TASK DURATION: 29 October 1971 to 27 February 1974

DESCRIPTION AND RESULTS: The snow shovel was fabricated with a folding handle that is convenient to use and easily held. Attached to one end of the handle is an ice breaker. The shovel blade is made of aluminum with a steel edge and also will fold for more compact storage. The shovel weighs 4-1/2 lbs and when foiled measures 8-1/2 in. wide and 21 in. long and 4 in. thick. Fifty test shovels were fabricated for test at U.S. Army, Alaska and Fort Devens.

TASK NUMBER: 06-S-72

TITLE: Knife Cutter-Bayonet

AUTHORIZED FUNDING: \$61,980

TASK DURATION: 4 November 1971 to 29 April 1974

CONTRACTOR: Benhof, Inc.

DESCRIPTION AND RESULTS: The Knife-Bayonet was designed to be used as a knife for close-in fighting and survival, a bayonet, a wire cutter, and a general tool. Both the knife and the scabbard are nonreflectant and light in weight. The blade is 7 inches long, 7/8 inches wide, and includes a light duty saw on the back of the blade. The scabbard is 8 1/4 inches long, by 2 inches wide. The scabbard includes as a component a utility screwdriver and a knife sharpener. The blade and scabbard lock together to allow a scissor action capable of cutting military barbed wire and barbed tape. All plastic materials used in the knife and scabbard are unaffected by standard military insect repellent. One hundred knife cutter-bayonets were provided to the U. S. Army Test and Evaluation Command for Military Potential Tests.

TASK NUMBER: 07-S-72

TITLE: Improved LWL Fuel Tablet

AUTHORIZED FUNDING: \$12,361

TASK DURATION: 22 November 1971 to 17 October 1972

DESCRIPTION AND RESULTS: A fuel tablet of acetal resin (Delrin) was developed by the U. S. Army Land Warfare Laboratory to be used in a combat meal stove. The tablet is 2 1/2" in diameter and 3/16" thick and two tablets constitute a fuel unit weighing 1.0 ounce. An ignition hole has been incorporated in the center or core of the tablet. To ignite, a match is placed in the hole, which is tapered to a thin edge, and within two to three minutes heating temperatures are attained. This can be accomplished with the fuel unit in the ration can stove, thus protecting it from the wind during ignition. The total burning time varies from ten to fifteen minutes depending upon wind conditions. Combat rations can be heated for consumption from the can or water can be heated in the canteen cup for the beverage or reconstitution of dehydrated rations. The tablet is rigid and will not break up or powder. It has an unlimited shelf life, is nontoxic, and is approved by The Surgeon General for packing with combat rations.

The U. S. Army Natick Laboratories sponsored Military Potential Tests by the U. S. Army Test and Evaluation Command in an arctic and a tropic environment.

TASK NUMBER: 08-S-72

TITLE: Oxygen Breathing Equipment for High Altitude Operations

AUTHORIZED FUNDING: \$10,743

TASK DURATION: 5 January 1972 to 27 October 1972

DESCRIPTION AND RESULTS: The oxygen breathing apparatus consists of a cylinder and valve assembly (3,000 psi), a reducer, a dilutor regulator, a face mask, a silicone rubber hose assembly and a sleeping mask. Charged weight of the apparatus is approximately 18 pounds. This equipment will provide a minimum of 5 hours usable oxygen at 20,000 feet and will function above -65°F. The most important component of this system is the dilutor demand regulator which conserves oxygen by utilizing available atmospheric oxygen and supplementing this with oxygen delivered by the system. Three spring loaded settings are provided on the regulator which can be manually changed to vary the ambient air dilution within the desired range. Five systems were provided to the Northern Warfare Training Center, Fort Greely, Alaska for operational use for high altitude rescue.

TASK NUMBER: 09-S-72

TITLE: Lightweight, Collapsible Pressure Cooker

AUTHORIZED FUNDING: \$79,286

TASK DURATION: 24 February 1972 to 11 April 1974

CONTRACTOR: Tracor/Jitco, Inc.

DESCRIPTION AND RESULTS: The collapsible pressure cooker has an aluminum pan at the bottom and an aluminum lid and breech lock closure ring at the top. These components are connected by a silicone rubber coated fiber glass shroud. Pressure regulation is achieved with an orifice through the lid and a regulating weight that opens the orifice when internal pressure exceeds 15 psi. A safety relief valve is provided that will vent the vessel interior whenever the internal pressure rises to approximately 25 psi. Folding handles enable handling of the pressure cooker like a conventional pot, while a supplemental handle on the lid facilitates operating the breech lock closure.

During the prototype testing a deficiency in a bond joint became evident. This bond was redesigned and a different bonding method developed. The unit was made available for field testing during the 4th Quarter FY74.

TASK NUMBER: 01-S-73

TITLE: Improved Fire Starter for All-Environment Survival Kit

AUTHORIZED FUNDING: \$9,850

TASK DURATION: 19 July 1972 to 8 February 1974

DESCRIPTION AND RESULTS: The Improved Fire Starter for the All-Environment Survival Kit packages all the necessary fire starting tools in one container roughly the size of a pack of stick chewing gum. A spark device (misch metal), a striker/shaver and necessary tinder are inclosed in a sealed container.

It is moisture proof and has a normal shelf life compatible with the All-Environment Survival Kit. It is suitable for all climatic and weather conditions use and is capable of starting a minimum of 30 fires with its organic tinder under survival conditions.

TASK NUMBER: 02-S-73

TITLE: Unfilled Requirements for Obtaining Potable Water Under Survival Conditions

AUTHORIZED FUNDING: \$69,467

TASK DURATION: 20 July 1972

CONTRACTOR: Applied Research & Development Laboratories

DESCRIPTION AND RESULTS: This task was designed to develop a deodorizer/desalter material for individual survival kits. The configuration and physical aspects of the deodorizer/desalter material will lend itself to inclusion in the Army survival kits. The ease of using the material will be compatible with an individual under stress in a survival situation.

The design was established and the prototypes for laboratory testing fabricated. Field evaluation was in progress at the time of deactivation.

TASK NUMBER: 03-S-73

TITLE: Improved Tent for the M-577 Command Track

AUTHORIZED FUNDING: \$35,991

TASK DURATION: 20 July 1972

CONTRACTOR: F. M. Stevenson

DESCRIPTION AND RESULTS: A lightweight, quick erectable structure which can be readily attached to the M-577 Command Track was developed. The structure is designed so that two, three or four vehicles can be interconnected back to back to form a large Command Post. The structure incorporates a ground cloth, is blackout proof and provides for the hanging of lights and map boards. Provision is also made for the entry of external wiring. A fire retardant nylon fabric provides the basic structure.

The tent is suitable for use in all climatic and weather conditions in Categories I through VI. A second prototype tent for the M-577 Command Track was fabricated by the contractor. The testing of this unit was conducted by the US Army Land Warfare Laboratory before evaluation quantities were fabricated. Evaluation was still in progress at the time of deactivation.

TASK NUMBER: 04-S-73

TITLE: Bunker/Tent Heater

AUTHORIZED FUNDING: \$95,746

TASK DURATION: 4 August 1972

CONTRACTOR: Pennsylvania State University

DESCRIPTION AND RESULTS: The Bunker/Tent Heater is a natural draft heater incorporating the latest technology in combustion and safety. It is a multifuel burning unit which can withstand transportation and use in tactical field conditions. It is suitable for use in all climatic and weather conditions (Categories I through VIII). The Heater is capable of being placed in operation and also dismantled, when cool enough to handle, by one man in five minutes. It can efficiently and safely burn JP4, gasoline, diesel, coal or wood as fuel.

TASK NUMBER: 05-S-73

TITLE: Lightweight Flotation Gear (EDT)

AUTHORIZED FUNDING: \$600

TASK DURATION: 18 October 1972 to 26 January 1973

DESCRIPTION AND RESULTS: The flotation gear developed by the U. S. Army Land Warfare Laboratory is equipped with an automatic inflator which inflates the three bladders when submerged in two feet of water. The device also has the option of being manually activated or breath inflated. A built-in safety device prevents inadvertent activation. The flotation device is worn around the waist above the pistol belt, and after inflation provides a bladder under each arm and one in front which supports the chin of the user. This front bladder keeps the head of an unconscious individual from going underwater. The device can be used with the standard rucksack frame, the combat pack, the parachute harness, or solely as a life vest.

The U. S. Army Land Warfare Laboratory was directed by the Department of the Army to discontinue further work on this task since a formal ROC was being staffed. The U. S. Army Natick Laboratories was designated the Parent Agency and is responsible for conducting the Engineering Design Testing.

TASK NUMBER: 06-S-73

TITLE: Multipurpose Silicone Rubber Cup

AUTHORIZED FUNDING: \$30,804

TASK DURATION: 20 November 1972

CONTRACTOR: R. E. Darling Company Inc.

DESCRIPTION AND RESULTS: The standard Army canteen cup is heavy and bulky. It weighs 7 ounces and occupies 43 cubic inches in volume. When drinking hot liquids from the cup, heat from the metal sometimes burns the user's lips. In arctic conditions the freezing of the user's lips to the canteen cup lip could occur with cold liquids.

The development cup was fabricated from glass reinforced silicone rubber and will weigh approximately one ounce. It measures four to five inches in height and three inches in diameter and holds approximately twelve ounces of liquid (water, coffee, tea, etc.).

The silicone rubber cup will withstand many flexings without failure and will be capable of low and high temperature use. Water can be boiled in the cup over a high temperature flame without damage and the material will not burn the user's lips when drinking. When drinking cold liquids from the cup in arctic conditions, the user's lips will not freeze to the cup lip. Evaluation was still in progress upon termination.

TASK NUMBER: 01-S-74

TITLE: Crampon for Use in Worldwide Mountain Operations

AUTHORIZED FUNDING: \$11,375

TASK DURATION: 13 August 1973 to 29 March 1974

DESCRIPTION AND RESULTS: The crampon will provide the user with the degree of foot mobility required to safely and successfully operate in those areas of the world which are characterized by ice and snow accumulations.

The crampons are constructed from a lightweight, durable material, are adjustable for use with the combat, ski, mountain and vapor barrier boot, and have 10 to 12 spikes so arranged that when worn at least 10 spikes are in full contact with the ground and provide maximum non-slip in all directions.

The project was coordinated with the U. S. Army Natick Laboratories. Commercial-type crampons were procured and fitted to standard Army footwear. Methods of adjusting the crampons were studied.

B-313

TASK NUMBER: 02-S-74

TITLE: Mechanical Map Light and Strobe Light

AUTHORIZED FUNDING: \$2,997

TASK DURATION: 13 August 1973 to 28 February 1974

DESCRIPTION AND RESULTS: At present, the U. S. Army does not have a mechanical low level light for map reading which is suitable for use in all environments.

A hand-operated generator to produce a low level light output for reading maps was designed. The device also incorporates a strobe-type signal light and is operable in all environments.

B-314

TASK NUMBER: 04-S-74

TITLE: Lightweight, Collapsible Litter

AUTHORIZED FUNDING: \$11,000

TASK DURATION: 7 September 1973 to 12 April 1974

DESCRIPTION AND RESULTS: A lightweight litter capable of being collapsed into a small volume so that it can be efficiently stored on vehicles and easily carried on a rucksack frame was designed. It is durable and easily maintained in a sanitary condition.

The litter is compatible with existing racks, brackets, and support systems for existing vehicles/aircrafts. It is suitable for use in all climates.

TASK NUMBER: 01-C-63

TITLE: Chemiluminescent Illuminating Devices

AUTHORIZED FUNDING: \$206,768

TASK DURATION: 11 December 1962 to 15 August 1966

CONTRACTORS: Miller Research; duPont Company

DESCRIPTION AND RESULTS: Object of this task was to investigate limited war applications of a chemiluminescent compound and to determine the feasibility of developing a family of devices to be used for marking and illumination.

a. Grenade: Development of a new formulation and matrix was completed. The new formulation will produce a signal on water as well as solid terrain. One hundred fifty grenades containing the new formulation were fabricated and shipped to Vietnam in response to the PROVOST requirement.

b. EX9 Chemical Light: Redesign of the EX9 Chemical Light was completed for USALWL by the U. S. Naval Ordnance Test Station, China Lake, California. Two hundred devices were received from USNOTS for evaluation. A Military Potential Test was requested through USATECOM. Forty-two markers were sent to Vietnam in April 1966 for demonstration.

TASK NUMBER: 02-C-63

TITLE: Flame Projector, Hand Held, One Shot Expendable

AUTHORIZED FUNDING: \$389,045

TASK DURATION: 11 December 1962 to 10 May 1968

CONTRACTORS: University of Cincinnati, Kettering Laboratory; Ethyl Corporation

DESCRIPTION AND RESULTS: Determine the feasibility of a small one-shot light-weight expendable flame projector having a range of approximately 25 yards. This flame projector will utilize as its incendiary material a charge of pyrophoric chemicals.

Static firing tests of the prototype projector were conducted during February 1964. Flight stabilization firing tests were conducted during March 1964. Functioned from the "Hip Fire" position, acceptable recoil forces are experienced by the operator. Additional performance tests and effect tests were conducted by LWL during June 1965 with satisfactory results. However, problems related to launcher contamination were not solved and all units fabricated were demilitarized.

TASK NUMBER: 03-C-63

TITLE: Chemical Agent System, Anti-Materiel

AUTHORIZED FUNDING: \$4,306

TASK DURATION: 11 December 1962 to 15 October 1963

DESCRIPTION AND RESULTS: Investigate and provide devices and/or techniques utilizing suitable chemical agents to render fuels, lubricants, electronic equipment and other sensitive and vulnerable material and equipment inoperable by selectively attacking components.

This task represented an extremely broad field and a substantial amount of work was accomplished by other Government and non-government laboratories. Visits were made to various organizations and numerous reports reviewed in monitoring the work being done pertaining to this task.

This was a continuing task to monitor the state of the art. Since no breakthrough applicable to limited war needs was identified at another Government or industrial lab, the task was terminated.

TASK NUMBER: 04-C-63

TITLE: Landing and Resupply Marking Systems for Day/Night Operations

AUTHORIZED FUNDING: \$73,279

TASK DURATION: 11 December 1962 to 3 May 1965

DESCRIPTION AND RESULTS: Design and develop an integrated system to be used for defining (a) the perimeter of air strips in remote areas, and (b) drop zones and helipads. The scope of the work included chemiluminescent panels, electroluminescent tapelight, and a day/night helipad identification system. This task was cancelled with the status of the components of the system as follows:

- (a) Chemiluminescent Panel Marker - approved as a separate task, Task 04-C-65.
- (b) Electroluminescent Runway Marker System - approved as a separate task, Task 05-C-65.
- (c) Helipad Identification Kit - a prototype helipad identification kit was fabricated and forwarded to the 11th Air Assault Division, Fort Benning, Georgia, for evaluation during the 1964 concept test. No results of this test were received.
- (d) Marker, Chemical, Location, EX9 - markers were developed by the U. S. Naval Ordnance Test Station, China Lake, California, and fabricated in color by them.

TASK NUMBER: 05-C-63

TITLE: Individual Identification Kit

AUTHORIZED FUNDING: \$15,175

TASK DURATION: 11 December 1962 to 7 September 1965

DESCRIPTION AND RESULTS: This task was conducted to determine the feasibility of developing a kit for marking personnel for the purpose of later identification. Of the many fluorescors available commercially, four organic compounds similar to those used in commercial laundries to mark clothing were selected as candidate agents. Gross toxicity determinations were conducted with these compounds. Data showed no difference between test animals and controls.

Testing of these compounds on skin, clothing and various types of terrain narrowed the choice of fluorescors to two: Oxazole Fluorescor F, (2-[5-(phenylureido)-2-hydroxyphenyl]-benzaxazole) and Thiazole Fluorescor G, (2-[5-(phenylureido)-2-hydroxyphenyl]-benzthiazole).

Of the many means of dissemination considered, a bounding type booby trap appeared to be the most promising. This device consists of (1) a 3.0 inch neoprene sphere filled with the fluorescor suspension and fuzed with the standard M206A2 grenade fuze, and (2) a plastic launcher containing a small ejection charge which is activated by a booby trap fuze. The fluorescor-filled sphere is ruptured 20 ± 5 feet above the ground and covers an area approximately 40 feet in diameter.

TASK NUMBER: 06-C-63

TITLE: Personnel Detector, Chemical

AUTHORIZED FUNDING: \$780,538

TASK DURATION: 12 March 1963 to 15 August 1966

CONTRACTORS: General Electric Company; Magna

DESCRIPTION AND RESULTS: Human beings and their equipment exude minute quantities of chemicals which can be used in detecting the presence of concealed personnel, provided that atmospheric concentration changes produced by the addition of minute quantities of these chemicals, can be detected. The objectives of this task were: (1) to search out and investigate promising concepts, principles and techniques for detecting concealed personnel by chemical means and (2) to determine the feasibility of developing a man-pack version of such a detector weighing approximately twenty pounds and capable of being carried and operated by one man while on foot patrol in tropic and semi-tropic environments. The results are described in detail in the body of this report under Project Execution.

B-321

TASK NUMBER: 07-C-63

TITLE: Anti-Crop Munitions

AUTHORIZED FUNDING: \$63,051

TASK DURATION: 12 March 1963 to 30 December 1965

CONTRACTOR: Miller Research

DESCRIPTION AND RESULTS: A study was conducted to investigate the feasibility of developing a simple, lightweight, air-droppable device which, when activated at a predetermined altitude, will be capable of contaminating an area of approximately one to three acres with any of several herbicidal chemicals. This device was intended to be used in the destruction of small rice paddies, poppy fields, and other vegetation.

The munition developed contained approximately 26 to 42 spheres, each containing 400 to 600 cc's of herbicidal agents. Laboratory and field test data indicated that it is feasible to disseminate herbicides in a predictable micron-size range utilizing this munition.

B-322

TASK NUMBER: 08-C-63

TITLE: Chemical Infra-Red Emitters

AUTHORIZED FUNDING: \$29,245

TASK DURATION: 12 March 1963 to 31 July 1964

CONTRACTOR: Midwest Research

DESCRIPTION AND RESULTS: A study to explore the field of infra-red emitting chemicals, with particular emphasis on compounds which, upon contact with air or light, emit radiation in the infra-red region of 0.8 to 1 micron. Such chemicals might be used to develop IR surveillance and detection systems.

No chemical IR emitting compounds were found as a result of the literature search and limited laboratory investigation conducted.

TASK NUMBER: 09-C-63

TITLE: Signal-Smoke

AUTHORIZED FUNDING: \$300,762

TASK DURATION: 1 April 1963 to 15 August 1966

DESCRIPTION AND RESULTS: Investigate, assess, and demonstrate means of employing colored smoke materials for signalling. This objective was extended to include the development of signal smoke units in four colors - red, yellow, green and white.

In conjunction with Picatinny Arsenal, a red signal smoke unit 1 inch in diameter by 1.25 inches high weighing 30 grams was fabricated and assessed. Military potential tests were scheduled to be conducted by USATECOM, but were cancelled in favor of ET/ST based on comments in a draft proposed SDR.

The signal consists of a smoke pellet wrapped in .001 gauge aluminum foil, an aluminum screw cap container, and an ignition system consisting of igniter cord, matchhead and scratcher. The signal is 1.75 inches high by 1.125 inches in diameter and weighs approximately 31 grams (1.1 oz.). The nominal burning time is 20 seconds. Twenty eight thousand ground smoke signals were shipped to Vietnam in June 1966 in response to the PROVOST program.

TASK NUMBER: 10-C-63

TITLE: Large Volume Screening Smoke Disseminator

AUTHORIZED FUNDING: \$29,227

TASK DURATION: 1 April 1963 to 1 January 1964

DESCRIPTION AND RESULTS: Devise a method for producing a large volume of screening smoke from a helicopter in flight for the establishment of a smoke screen to screen helicopter landing operations. The smoke should be non-toxic, non-corrosive and non-irritant in order to minimize discomfort to friendly personnel.

The technique investigated emphasized the generation of hot gas by a gas turbine in order to volatilize a non-toxic smoke agent.

The addition of fog oil (SFG No. 2) into the hot exhaust gases of a Solar T62T-21 turbine was investigated initially since these turbines are on hand in Vietnam. Tests conducted at LWL on the T62T-21 turbine produced insufficient smoke when operated from a UH-1A helicopter at an operational speed of 90 knots and at an altitude of 60 feet.

TASK NUMBER: 01-C-64

TITLE: Improved Smoke Screen (Air Activated)

AUTHORIZED FUNDING: \$281,283

TASK DURATION: 1 March 1964 to 1 January 1969

CONTRACTOR: Ethyl Corporation

DESCRIPTION AND RESULTS: The purpose of this task was to investigate techniques, principles and agents for generating large volumes of non-toxic, non-corrosive, and non-irritant smoke for tactical operations. The agent should be a low-density, liquid, bulk chemical that can be used with available military hardware. It should be disseminated from military aircraft, including helicopters to produce a smoke screen without auxiliary pumping equipment or heat source.

A non-corrosive, non-irritating, non-toxic screening agent was developed. Designated as formula 90207-98 it is composed of a mixture of alkyl aluminum organometallic compounds, tri-ethylaluminum and triisobutylaluminum and alpha methyl naphthalene. When dispersed into the atmosphere, a voluminous white smoke is formed by the reaction between the agent and atmospheric oxygen.

Approximately 15,000 lbs. of liquid agent were tested successfully. The agent was dispersed from the A-4 jet aircraft at speeds up to 300 miles per hour and A-1 (propeller) aircraft at speeds up to 150 miles per hour, as well as the H-19 and H-34 helicopters at speeds up to 70 miles per hour.

Dispensing from the fixed wing aircraft was made with the MK-12 spray tank. Dispensing from the rotary wing aircraft was made using a dispensing nozzle ring mounted on the side of the aircraft. The tests were completely successful.

TASK NUMBER: 02-C-64

TITLE: Grain Study Development

AUTHORIZED FUNDING: \$250,617

TASK DURATION: 24 April 1964 to 21 February 1967

CONTRACTOR: Miller Research Corporation

DESCRIPTION AND RESULTS: To investigate and to determine a method to render rice unfit for human consumption, and/or a method to destroy rice found in caches in those instances where it is not practical to be removed from the cache site.

A kit was developed for use on enemy rice caches. It weighs about two and one-half pounds and is capable of contaminating and rendering unfit for human consumption, two and one-half tons of rice. The kit contains eight dispersing cartridges, two aerosol cans and two actuating-launcher guns. Each cartridge and aerosol can is capable of contaminating approximately five hundred (500) pounds of rice. The cartridges when actuated, disseminate the chemicals into bulk stored, or bagged rice caches.

B-327

TASK NUMBER: 01-C-65

TITLE: Flame Projectile, Indirect Fire

AUTHORIZED FUNDING: \$96,747

TASK DURATION: 3 August 1964 to 14 July 1967

CONTRACTORS: Bendix Corporation; Atlantic Research Corporation

DESCRIPTION AND RESULTS: A study was conducted to determine the feasibility of placing flame and/or chemicals 500 meters or more by utilizing the M301-81MM flare round modified to carry a payload of a pyrophoric fuel. Sufficient rounds were fired to establish the ballistic stability and to ascertain that the round matches the ballistics of the M301-81MM flare round. Extensive fuel research showed that triethyl aluminum can be sufficiently inhibited and maintain sufficient reactivity to produce an incendiary effect on the target.

B-328

TASK NUMBER: 02-C-65

TITLE: Integral Smoke Generator (Airborne)

AUTHORIZED FUNDING: \$533,137

TASK DURATION: 3 August 1964 to 29 February 1968

CONTRACTORS: Bendix Corporation; Agricultural Aviation Engineering Company

DESCRIPTION AND RESULTS: The Integral Smoke Generator consists of a smoke agent tank, smoke agent pump, necessary piping, and a spray-type nozzle assembly. The nozzle assembly is mounted on the UH-1 aircraft turbine exhaust stack so that the smoke agent is directed into the hot turbine exhaust gases. When the aircraft turbine is in operation, the integral smoke generator may be operated to produce dense clouds of smoke either in flight or as a ground based smoke generator.

Twenty militarized integral smoke generators with spares and tools were delivered to Vietnam in Feb 67. An ENSURE Request was received from Vietnam for one hundred seventy-two (172) generators and the U. S. Army Edgewood Arsenal, the designated parent agency, was appointed the responsible agency for meeting the ENSURE Request. Development of an integrated CS dispenser was initiated.

B-329

TASK NUMBER: 03-C-65

TITLE: Riot Control Device (Individual)

AUTHORIZED FUNDING: \$28,392

TASK DURATION: 3 August 1964 to 9 December 1965

DESCRIPTION AND RESULTS: Investigate the feasibility of a chemical riot control munition which can be used as both a hand held weapon and as a hand thrown device to dispense chemical riot control agents. A prototype munition was fabricated. Preliminary design testing of the prototype as a hand held weapon was conducted with simulants to determine range, ease of operation and versatility and tests of prototype munitions using riot control agents were conducted prior to termination.

B-330

TASK NUMBER: 04-C-65

TITLE: Chemiluminescent Panel Marker

AUTHORIZED FUNDING: \$77,748

TASK DURATION: 13 April 1965 to 15 August 1966

CONTRACTOR: E. I. duPont deNemours & Company, Central Research Department

DESCRIPTION AND RESULTS: The chemiluminescent panel is a self-contained plastic envelope, transparent on one side only, containing a porous substrate impregnated with a chemiluminescent compound. Two tear strips are located on the transparent side of the panel for activation. The panel emits a medium intensity light in the blue-green region of the spectrum through an oxidation process when exposed to air.

Toxicity testing of the chemiluminescent formulation employed was completed and a favorable report prepared by U. S. Army Edgewood Arsenal. Panels were fabricated and sent to U. S. Army General Equipment Test Activity, Fort Lee, Virginia, in May 1966 for ED Test. An additional 1500 panels were fabricated for delivery to Vietnam in response to a QR request.

B-331

TASK NUMBER: 05-C-65

TITLE: Electroluminescent Airfield Lighting System

AUTHORIZED FUNDING: \$196,686

TASK DURATION: 13 April 1965 to 26 September 1967

CONTRACTOR: Sylvania Electric Products

DESCRIPTION AND RESULTS: The system employs flexible electroluminescent tape as the light source. Each lamp consists of a 48 inch section of tape mounted on a fixture capable of rapid ground emplacement. Each system contains green runway lights, yellow taxi lights, and red obstruction lights. The system may be operated from conventional ac power sources, as well as the battery operated power supplies provided with the package.

Design of all components of the system was completed. Twelve systems were fabricated, six of which were sent to Vietnam in June 1966 to meet the PROVOST requirement. Fourteen additional systems were sent to Vietnam in October 1966.

TASK NUMBER: 01-C-66

TITLE: Airborne Personnel Detector

AUTHORIZED FUNDING: \$85,389

TASK DURATION: 26 July 1965 to 19 January 1966

DESCRIPTION AND RESULTS: The equipment is designed to detect air contaminants generated by human activities. Integrated interpretation of the signals in terms of the geographical position of the aircraft sensor should provide an estimate of the location of the target signal source. The system was installed on the OV-1B aircraft and the UH-1D aircraft. Development tests were conducted in Panama, Dugway Proving Ground, Hawaii and Florida to provide a meteorological model for estimating source location.

The system is capable of detecting air contaminants generated by human activity under favorable meteorological conditions. Location of the aircraft is displayed on a navigation plotting board. On interception of a signal, the estimated source location is displayed by an off course plot and on a digital readout in UMT coordinates. Tests established the feasibility of detecting sources in contaminated backgrounds by analysis of mission data recorded digitally on magnetic tape. The analysis augments the real time source data acquired during the surveillance mission. Development of the procedures for post mission analysis were explored. U. S. Army Electronics Command was the designated parent agency for this task.

TASK NUMBER: 02-C-66

TITLE: Assessment of Projector, Flame, Counterambush

AUTHORIZED FUNDING: \$33,170

TASK DURATION: 27 August 1965 to 23 December 1966

DESCRIPTION AND RESULTS: This task was designed to experimentally determine the applicability of scaling-up the Flame Projector, developed under another task. The scaled-up version had a capacity of approximately 1/2 gallon of an inhibited organometallic fuel, a cannister range of 100 yards and a potential dispersion pattern on the ground of 270 feet in length and 30 feet each side of path of trajectory.

The projector, flame, counterambush consists of a steel projector 23" long x 4-1/4" in diameter containing an electrically activated fuze and propellant plus an inner cannister containing a viscous, pyrophoric, hypergolic fuel. The cannister upon ejection from the projector, is time fuze delayed for 0.2 seconds to activate a piston which ejects the fuel radially over the trajectory.

TASK NUMBER: 03-C-66

TITLE: Personnel Detection, Chemical (Vehicular TO - IF)

AUTHORIZED FUNDING: \$1,528,818

TASK DURATION: 20 October 1965 to 30 September 1969

CONTRACTOR: General Electric

DESCRIPTION AND RESULTS: The Personnel Detector (Vehicular and TO-1 D/F) is a device mounted on a ground vehicle or O-1 aircraft for the purpose of detecting target personnel at a militarily useful range. Prototype units of the vehicular and TO-1 D/F personnel detector systems were tested in Thailand in Sep 66. Ten TO-1 D/F systems and ten vehicular systems were fabricated for operational evaluation. These systems contain modifications following recommendations generated as a result of the Thailand tests. Tests of these modifications were completed in Feb 67. Five TO-1 D/F personnel detector systems were sent in Apr 67 to SEA for operational evaluation.

TASK NUMBER: 04-C-66

TITLE: Explosive Detector

AUTHORIZED FUNDING: \$187,868

TASK DURATION: 22 October 1965 to 3 January 1968

CONTRACTOR: General Electric

DESCRIPTION AND RESULTS: The explosive detector consists of a condensation nuclei detector and a converter for changing explosive vapors to CN type particles. This unit provides the capability of detecting the presence of concealed explosives by the detection of their characteristic vapors.

The vapors of small quantities of C-3, C-4, TNT, RDX, Comp B, Pentolite, Tetryl and 40% dynamite were detected at a distance of one inch from the converter input. The vapor pressure of most explosives is very low and this results in a very small quantity of effluent being evolved. Three different types of effluent converters were evaluated in an effort to obtain the maximum possible sensitivity and range. Modifications were made in order to reduce the loss of signal in the detector. A prototype R&D unit was field tested in Jul 67 in CONUS.

TASK NUMBER: 05-C-66

TITLE: Chemical "Fireball", Assessment of Effectiveness

AUTHORIZED FUNDING: \$141,961

TASK DURATION: 14 December 1965 to 15 January 1968

CONTRACTORS: Hazleton Laboratories, Inc.; Technidyne, Inc.

DESCRIPTION AND RESULTS: A study was performed to investigate the feasibility of a proposed chemical fireball counterambush weapon system. Specifically, the proposed system was to provide a long-range (beyond 70 meters) complement to another short-range counterambush system. The study, however, considered not only the primary long-range potential of the proposed counterambush system, but also the proposed system's effectiveness over the ambush target as a whole. It appeared from the study that four munitions fired per side of a truck would be reasonably effective in the primary target area (beyond 70 meters) and would also produce some desired effects in the first 70 meters of the overall target area. In addition, since large portions of the target areas would probably be subjected to radiation of the "flash blindness" level while at the same time be threatened with possibly "severe" burn levels, the primary ingredients for psychological effectiveness would be present. However, the psychological factor could not be considered in a quantitative fashion for lack of meaningful effectiveness criteria.

TASK NUMBER: 06-C-66

TITLE: Personnel Detector (Airborne)

AUTHORIZED FUNDING: \$5,749,227

TASK DURATION: 27 December 1965 to 6 October 1969

CONTRACTOR: General Electric

DESCRIPTION AND RESULTS: A study was conducted to develop equipment capable of detecting air contaminants generated by human targets and their activities and provide an integrated interpretation of the signals in terms of the geographical position of the aircraft sensor and an estimate of the location of the target signal source. The equipment was mounted on fixed and rotary winged U. S. Army aircraft.

Tests were conducted in Panama, Dugway Proving Ground and Florida to develop a source prediction model for signal evaluation. These tests confirmed the capability of the system to detect human generated air contaminants from aircraft under favorable meteorological conditions. A C-47 aircraft incorporating all the components of the system was outfitted for extensive testings. Components of the detection system were test flown to determine component effectiveness and experimentally verify system variables. USAMC was the designated parent agency.

TASK NUMBER: 07-C-66

TITLE: Miniature CS Disseminator

AUTHORIZED FUNDING: \$42,469

TASK DURATION: 29 December 1965 to 21 November 1967

DESCRIPTION AND RESULTS: The system provides for the dissemination of encapsulated agent "CS" into an aerosol by means of the heat energy generated from a pyrotechnic fuel. Each unit has a self-contained ignition system, an approximate ratio of fuel to agent "CS" of 2:1, a dissemination time of six to eight seconds and minimum degree of target area obscuration. The units measure 1-1/8 inches in diameter and are 1-1/4 inches high. Total gross weight per unit is 1.1 to 1.2 ounces.

A total of two hundred and fifty (250) prototype units were produced. Representative samples of the prototype fabrication satisfactorily passed stability and system compatibility tests.

TASK NUMBER: 08-C-66

TITLE: Road and Trail Interdiction

AUTHORIZED FUNDING: \$848,569

TASK DURATION: 25 March 1966 to 14 July 1967

CONTRACTOR: General Dynamics

DESCRIPTION AND RESULTS: A study was made to provide some basic numerical values for determining the feasibility of employing various aircraft to operationally dispense foot-penetrating devices into selected ground areas. The results of the study were presented in graphical form to permit rapid estimates of some of the important problem parameters, e.g., area length and width and the distribution density of devices for any given rectangular seeded area. These results are incorporated in an "internal-use-only" document, RAB Note No. 26, "The Delivery of Foot-Penetrating Devices by Various Aircraft."

B-340

TASK NUMBER: 01-C-67

TITLE: Man-Pack Detector E-63

AUTHORIZED FUNDING: \$16,419

TASK DURATION: 22 August 1966 to 14 July 1967

DESCRIPTION AND RESULTS: The manpack personnel detector is a device intended to alert a foot patrol to the presence of concealed humans in ambush by detecting certain human chemical effluents. The prototype manpacked personnel detector is approximately 19 inches long, 14 inches wide and 6 inches deep. The detector pack has been designed for attachment to the standard lightweight rucksack frame. It consists of a probe and a case containing a power pack and instrumentation, and a meter read-out device and gain control. The instrumentation package consists of a pump, expansion chamber, valving and circuitry to provide read-out signals. The item was evaluated in Vietnam with ACTIV assistance and responsibility for the item was placed with the designated parent agency, USAMUCOM/USAEA.

TASK NUMBER: 02-C-67

TITLE: Detection by Biochemical Luminescence

AUTHORIZED FUNDING: \$70,509

TASK DURATION: 14 November 1966 to 19 July 1968

CONTRACTOR: Resources, Planning and Control Corporation

DESCRIPTION AND RESULTS: Certain bioluminescent microorganisms have been shown to be affected by the effluents of man and his activities. This task was concerned with the feasibility of utilizing microorganisms of this type in a detector capable of being operated and carried by one man.

The detector for the subject system consists of two basic parts encased in one lightweight box. One part embraces the electronic circuitry, power supply and photoelectric tube. The second part contains the sensor, microorganism and readout scale. The total unit as described above, now weighs approximately nine pounds. The system is powered by 8.4 Volts delivered by nine rechargeable batteries that will provide 40 hours of continuous operation. The air pump is rheostat controlled for use in various environments and at different rates of speeds.

Tests gave conclusive evidence that the microorganism definitely responded to the presence of human effluents. It has also been determined that the selected microorganisms do not respond to normal atmospheric contaminants.

B-342

TASK NUMBER: 03-C-67

TITLE: Helicopter-Adaption of TO-1D/F Detector System

AUTHORIZED FUNDING: \$22,117

TASK DURATION: 19 December 1966 to 18 July 1967

DESCRIPTION AND RESULTS: The personnel detector (UH-1B/D) is a device mounted internally in a UH-1B/D with an air sampling scoop to detect target personnel at a militarily useful range. Testing of the personnel detector UH-1B/D was completed in Feb 67. Five modification kits were fabricated to adapt TO-1D/F detection systems for helicopter installation. These kits were supplied with 5 TO-1D/F systems delivered to SEA in Apr 67. USAMUCOM/USAEA was the designated parent agency.

B-343

TASK NUMBER: 04-C-67

TITLE: Interdiction Device, Hand Implaced

AUTHORIZED FUNDING: \$2,522

TASK DURATION: 19 January 1967 to 13 June 1967

DESCRIPTION AND RESULTS: The interdiction device consists of a 1/4 inch by 3-1/4 inch OD polystyrene ring to which two 1.38 inch steel scimitar-type blades are riveted. A degradation feature is incorporated into the device by placing a pellet of 80% cupric chloride/20% silica into a cavity in the plastic ring directly under each rivet. The pellet is sealed in place ultrasonically by means of a 2 mil polystyrene membrane over which is placed a 20 mil polystyrene retainer disc having five small holes for water vapor penetration. Fifty containers, each containing 30 interdiction devices, were shipped to Vietnam on 5 Apr 67 in response to an ENSURE Request.

TASK NUMBER: 05-C-67

TITLE: Feasibility of Grain Pulverization Under Field Conditions

AUTHORIZED FUNDING: \$13,374

TASK DURATION: 9 February 1967 to 25 August 1967

DESCRIPTION AND RESULTS: The objective of this task was to develop a portable grain mill suitable for use under field conditions for the purpose of disposing of large grain caches. The task was terminated after a feasibility study and preliminary fabrication work.

TASK NUMBER: 06-C-67

TITLE: Ringtrop Dispensing System for the C-123 Aircraft

AUTHORIZED FUNDING: \$212,371

TASK DURATION: 5 April 1967 to 5 April 1968

CONTRACTOR: General Dynamics

DESCRIPTION AND RESULTS: A system for dispensing an interdiction device from the C-123 aircraft was developed. The dispensing mechanism is the same as developed for the CH-47 helicopter with minor modifications to the dispenser head (chute) and a major redesign of the feeder system to better accommodate the payload capability of the C-123 aircraft. Delivery rate of dispenser is variable, two boxes per 1.5 sec., or two boxes per 4 seconds.

The following objectives were accomplished under the contract:

- a. Safety of dispersion and dispersion pattern correlation.
- b. Feeder redesign for Air Force qualification.
- c. All equipment, drawings and spare parts designated under the contract have been delivered to USALWL.

TASK NUMBER: 07-C-67

TITLE: Improved Electroluminescent Airfield Lighting

AUTHORIZED FUNDING: \$233,011

TASK DURATION: 2 May 1967 to 25 May 1970

CONTRACTOR: Sylvania Electric Products

DESCRIPTION AND RESULTS: The major component uses electroluminescent tape as the light source. Each lamp consists of an inverted U shaped rigid plastic ground mounting device which contains two 20" fiberglass encapsulated tapelights. The ground mounting device is designed to facilitate rapid ground emplacement. The tapelights are: green for runway lights; yellow for taxiway lights and red for obstruction lights. Each light may be operated from conventional AC power sources, as well as by a battery-operated power supply provided with the package.

Tests have been successfully completed on the ground mounting devices both in a wind tunnel and in the field. The fixtures were found capable of withstanding wind speeds up to 120 mph without deterioration. Lamps were subjected to operating conditions of 125 degrees F, 95% RH and 70 degrees F, 95% RH and 70 degrees F, 50% RH. Life to half-brightness under the 70 degrees F, 95% RH condition is approximately 600 hours.

B-347

TASK NUMBER: 08-C-67

TITLE: Detection and Evaluation by Neutron Activation Analysis

AUTHORIZED FUNDING: \$113,030

TASK DURATION: 3 May 1967 to 24 December 1968

CONTRACTOR: Texas A & M Research Foundation

DESCRIPTION AND RESULTS: The method investigated is to distribute very small quantities of an active, non-toxic, coded metallic powder over a surveillance area. This powder is picked up on clothing, shoes, feet or wheels of vehicles. The material is recovered from the subject using a small portable vacuum cleaner. The recovered coded material is irradiated with 14 MeV neutrons using a portable activation analysis system. The presence of a characteristic signature spectrum after activation indicates that the subject in question was, at some previous time, marked with the material either directly or indirectly. This provides intelligence regarding his identification or his past areas of activity.

The results of all tests were positive. Due to lack of user interest, the program was brought to conclusion.

B-348

TASK NUMBER: 01-C-68

TITLE: Investigation of Technique for Felling Large Diameter Trees

AUTHORIZED FUNDING: \$24,876

TASK DURATION: 7 August 1967 to 17 June 1968

CONTRACTOR: Explosives Corporation of America

DESCRIPTION AND RESULTS: A two month study was conducted to determine the feasibility of felling trees from two to four feet in diameter by pouring a liquid explosive into a slot or slots cut into the trunk of the tree and initiating it by means of a conventional detonator.

TASK NUMBER: 03-C-68

TITLE: Landing Zone Director's Signal System

AUTHORIZED FUNDING: \$17,092

TASK DURATION: 26 October 1967 to 24 December 1968

CONTRACTOR: Madigan Electronics

DESCRIPTION AND RESULTS: This system contains two electroluminescent signal paddles and a signal apron. Each paddle consists of a two "D" cell flashlight and has, in lieu of the lighthouse, an electronic inverter into which a 2" x 12" hardbacked green electroluminescent tapelight is plugged. The signal apron consists of two 2" x 12" tapelights set in clear vinyl plastic pockets in a "T" configuration on a rectangular olive drab colored, rot-resistant cloth apron. Two pockets are provided to retain the flashlight battery cases to the apron. An adapter cord connects the battery case to the tapelight for operation. Two additional pockets are provided for spare batteries. Adjustable straps, employing "Velcro" strips, are used in retaining the apron on the wearer.

The 1st Air Cavalry Division evaluated 20 systems during November and December 1968. Upon completion of the evaluation, the evaluation report stated a desire for additional systems. USARV requested additional systems through ENSURE No. 299 which has been approved by DA and assigned to USAMC (USAECOM).

TASK NUMBER: 04-C-68

TITLE: Soil Sterilants

AUTHORIZED FUNDING: \$110,473

TASK DURATION: 1 December 1967 to 10 May 1968

DESCRIPTION AND RESULTS: The primary purpose of this task was to use a commercial fertilizer spreader and an LWL air dispenser system in distributing a soil sterilant to control a wide range of weeds and grasses. The ground spreader was a commercially available fertilizer spreader used for distributing lime, etc. The air dispenser was developed under a separate task for the purpose of distributing interdiction devices from UH-1D and CH-47 helicopters. The soil sterilant was a commercially available herbicide, Bromacil.

Tests to determine the various parameters involved in attaining the desired ground density contamination were conducted using the ground spreader and the air dispenser for the UH-1D. When MACV withdrew the requirement for this system, pending DA direction, USALWL placed in temporary storage, two ground spreaders, 10,000 pounds of Bromacil and 1,400 pounds of inert simulant. USAMUCOM was the designated parent agency for this task.

B-351

TASK NUMBER: 05-C-68

TITLE: Refill of CS Helicopter Lachrymator Dispensers

AUTHORIZED FUNDING: \$11,405

TASK DURATION: 25 January 1968 to 11 June 1968

DESCRIPTION AND RESULTS: Sufficient bulk agent CS and methylene chloride, viton bladders, rupture disks, CO2 propellant cartridges and mixing equipment were supplied to provide for 24 refills of a lachrymator dispenser under evaluation in Vietnam.

Units were shipped to RVN on 15 May 68. USAMUCOM/USAEA was the designated parent agency for this task.

TASK NUMBER: 06-C-68

TITLE: Explosive Detector - Chemiluminescence Technique

AUTHORIZED FUNDING: \$57,703

TASK DURATION: 7 February 1968 to 30 September 1969

CONTRACTOR: Stanford Research Institute

DESCRIPTION AND RESULTS: This effort was a laboratory feasibility study to determine if explosive vapors could be selectively detected by chemiluminescence techniques. Air which has been in contact with explosives contains small amounts of the vapor of organic nitroso, nitro, or nitrate compounds. If the air is heated to approximately 1250 degrees K, these compounds will decompose rapidly to give nitric oxide or nitrogen dioxide. When these chemical species are mixed with atomic oxygen, a chemiluminescent chain reaction occurs. This reaction yields light with a spectrum peaking in the violet. The light can be detected with high efficiency by a photomultiplier tube. This project: (1) designed an apparatus to detect gases of nitrogen-bearing compounds, (2) constructed the apparatus, and (3) performed laboratory experiments with the apparatus.

A laboratory instrument was constructed and tested. The instrument did not appear to offer either the sensitivity or selectivity required to reliably detect explosives at a militarily useful range.

TASK NUMBER: 07-C-68

TITLE: Improved Airborne Personnel Detectors

AUTHORIZED FUNDING: \$794,265

TASK DURATION: 14 February 1968 to 30 September 1969

CONTRACTOR: General Electric

DESCRIPTION AND RESULTS: This CN personnel detector is a device that is designed to be employed in the UH-1, O-1 or O-2A aircraft for the purpose of detecting target personnel at a militarily useful range. In the aircraft carried mode of operation, the equipment is used to detect the presence of target personnel in suspicious sites on the ground by detecting the small quantities of effluents generated by human activity. The detector system is designed to be mounted on the inside of the aircraft.

Design and field testing of this device was completed and 20 improved systems were delivered to RVN in response to ENSURE 235. The designated parent agency (USAMUCOM/USAEA) was assigned the responsibility for the remaining 45 units and provisioning of ENSURE 235.

A portion of the 20 units were field tested for Army acceptance. At the successful completion of the tests, the units were deployed to SEA.

B-354

TASK NUMBER: 08-C-68

TITLE: Helicopter Lachrymator Dispenser

AUTHORIZED FUNDING: \$405,516

TASK DURATION: 12 March 1968 to 15 December 1969

CONTRACTOR: Bendix Corporation

DESCRIPTION AND RESULTS: The system was designed to enable external carriage from UH-1D helicopters for dissemination of CS agent. When carried internally, one or two dispenser systems can be used; however, when carried externally, two dispenser systems must be employed to prevent an asymmetric loading condition.

The operation of the entire system is electromechanical and no explosive devices are employed. The pilot/co-pilot can operate the two lachrymator dispenser systems simultaneously or sequentially. The lachrymator dispenser is compatible with the XM52 smoke generator helicopter system; the lachrymator dispenser system and XM52 smoke generator system may be operated simultaneously or independently of each other.

Twenty-two systems were shipped to RVN for evaluation in May 1969. Also shipped were 110 drums of a 27% CS in methylene chloride solution. Due to interface problems between the aircraft and the dispenser, the system was not evaluated. All lachrymator dispenser systems were returned to CONUS for rework. The U.S. Army Edgewood Arsenal, the designated parent agency for this item, received preliminary technical data.

TASK NUMBER: 09-C-68

TITLE: Riot Control Device, Vehicular Mounted (RC)

AUTHORIZED FUNDING: \$45,621

TASK DURATION: 27 March 1968 to 29 July 1969

DESCRIPTION AND RESULTS: a. CS Disseminator 1/4-ton Vehicle: A kit consists of five disposable metal cans containing one quart each of the solvent used (methylene chloride); a venturi nozzle arrangement that bolts to the tailpipe of the vehicle exhaust; a control valve to be attached to the solvent container; sufficient flexible hose to connect the container with the tailpipe venturi; a bracket for suspending the solution container inside the vehicle; an aspirator bulb to provide air pressure to expel the solution into the exhaust, and sufficient agent CS in tablet form to provide a 4% by weight concentration of agent CS per quart of solvent.

b. CS Disseminator Military Police Sedan: The system, a compact panel mounted unit designed for installation in the trunk (luggage) compartment of the vehicle, consists of two, one quart capacity metal cans mounted in a holder, solenoid valves to control flow and a small electric pump. A line from the pump discharge leads to a spray nozzle located on the end of the vehicle exhaust. Controls for activating the unit are located on the vehicle dash.

Ten units (1/4 ton vehicle) and eight units (military police sedan) were evaluated by USCONARC during 1st Qtr FY70. The evaluating unit was the 519th Military Police Battalion, 14th Military Police Group. Tests indicated that the small quantity of agent released, plus the wind dependency of the system made the technique unacceptable for use.

B-356

TASK NUMBER: 10-C-58

TITLE: Measurement of Military Explosive Vapors

AUTHORIZED FUNDING: \$130,094

TASK DURATION: 22 April 1968 to 20 September 1971

DESCRIPTION AND RESULTS: The initial effort under this task was to determine the vapor pressure of seven military explosives from room temperature to melting point; and to identify and determine quantitatively the materials responsible for the vapor pressure. The seven explosives were TNT, Comp B, C-4, C-3, Pentolite, Teteryl and RDX (Cyclonite). This effort is complete and has been reported in BRL Report No. 1507, "Characteristics of Certain Military Explosives." A follow-on effort was initiated to measure the relative adsorption of various explosive effluents on specific materials proposed for the sample acquisition train of the aircraft-mounted, explosive vapor, plasma chromatograph detection system. This study showed that the proposed method of obtaining sample air containing TNT and transmitting the effluvia to the detector requires the sample train to be heated to minimize TNT adsorption on the walls. The information gained on this effort is being used to improve the air sampling system by utilizing components which will allow a greater quantity of explosive effluents that are acquired by the air sampling system to reach the sensor for detection.

TASK NUMBER: 01-C-69

TITLE: Development of Biochemical Detector

AUTHORIZED FUNDING: \$572,775

TASK DURATION: 23 July 1968 to 17 September 1971

CONTRACTOR: Resources, Planning and Control Corporation

DESCRIPTION AND RESULTS: This task was to determine through Laboratory procedure the parameters for a biological detector using luminescence of microbiological organisms in the detection of human effluvia. The detector for the subject system consists of two modular, calibrated, detection units containing a biosensor retention device, photochemical sensor unit, readout indicators, sampling tube and an environmental control unit. The detector is a self-contained unit and is designed for airborne operation in a helicopter.

Extensive laboratory testing was conducted consisting of screening sensors with chemicals known to be associated with man, evaluating the effects of contaminants on the sensitivity of sensors to effluent chemicals, selecting strains of sensor bacteria which demonstrated sensitivity to human effluent and evaluating temperature/relative humidity/sensitivity relationships. To evaluate the response signature associated with humans, an in-house effort consisting of an effluent chamber was constructed to permit effluvia from humans to be sampled for detection thresholds and determinations of concentrations per unit volume of the selected effluents. Comparisons of different detector techniques under controlled conditions for determining relative sensitivity, specificity and comparative response time were also conducted. Results showed the biosensor to be responsive to the effluent of man, but its sensitivity was deemed insufficient for military applications.

TASK NUMBER: 02-C-69

TITLE: Explosive Detector - Ionization Potential Technique

AUTHORIZED FUNDING: \$47,089

TASK DURATION: 5 August 1968 to 1 August 1969

CONTRACTOR: Honeywell, Inc.

DESCRIPTION AND RESULTS: This task was to design, build, evaluate and field test a prototype explosive vapor detector based on the principle of ionization potential of vapors. The investigation was to emphasize the specificity of the technique of measurement of the ionization potential of explosive vapors and establish the limits of its sensitivity. A portable prototype system, modular in construction, was fabricated to provide a test vehicle.

A six-month laboratory and limited field test study was completed. A prototype instrument was constructed, tested and delivered to USALWL. The instrument did not offer either the sensitivity or selectivity required to reliably detect explosives at a militarily useful range.

TASK NUMBER: 03-C-69

TITLE: Investigation of Shipping Volume Reduction of Plastic Shapes

AUTHORIZED FUNDING: \$50,385

TASK DURATION: 8 August 1968 to 15 August 1969

CONTRACTOR: RAI Research Corporation

DESCRIPTION AND RESULTS: This task investigated the feasibility of reducing the volume of plastic objects in order to optimize their size for packaging and shipping purposes. The items being investigated were the plastic canteen and five gallon plastic water container.

This technique crosslinks the polymer by gamma radiation which, in turn, imparts a "memory" to the objects irradiated. This "memory" enables the objects to be heated, then compressed for shipping purposes. Upon arrival at their destination, the application of heat regenerates them to their original configurations. In their compressed state, these objects occupy 30-50% of their original volume.

The technical feasibility of compression and regeneration was demonstrated. A separate logistical study conducted by LWL on this technique indicated that, because of the high initial equipment cost for the relatively few canteens and five gallon containers manufactured and stored annually by the Government (i.e., the high unit cost), further effort was not warranted by this Laboratory. This does not preclude use of this technique by other Government organizations where this technique could apply.

B-360

TASK NUMBER: 04-C-69

TITLE: Smoke Generator Internal Combustion Engine

AUTHORIZED FUNDING: \$46,907

TASK DURATION: 15 August 1968 to 3 June 1969

CONTRACTOR: Bendix Corporation

DESCRIPTION AND RESULTS: In this system smoke is generated by introducing fog oil into the hot exhaust gases of the engine. Oil injection is accomplished by using a positive displacement type pump having a capacity ranging from 1/2 to 3 gallons per minute through suitable orifice nozzles at pressures ranging from 10 to 60 psi. The system includes an oil reservoir. Tests were successfully completed on the M10 personnel carrier and Hurricane airboat.

TASK NUMBER: 05-C-69

TITLE: Mini-Grenade Munitions

AUTHORIZED FUNDING: \$325,561

TASK DURATION: 19 August 1968 to 28 May 1971

DESCRIPTION AND RESULTS: The U.S. Army Land Warfare Laboratory, with the U.S. Army Picatinny Arsenal, developed a series of miniaturized flare munitions similar to the XM166 smoke signals. The flare consists of a plastic case 1.45" in diameter by 1.8" high with a sleeve on one side to accommodate the ignition system. Ignition is accomplished by means of a pull-wire igniter and igniter cord. The signal is available in three colors: red, yellow and green. Nominal burning time is 40 seconds for the green, and 70 seconds for the red and yellow signals. The flare has been given the designation: Signal, Illumination, Ground, Yellow, XM191; Green, XM192; Red, XM193.

Three-thousand signals were shipped to ACTIV and evaluated during the period 1 Nov - 31 Dec 69. Results of the evaluation showed that the item would be suitable for use in RVN if: (a) the item could be modified to permit it to be thrown, and (b) the delay time to ignition could be increased. The signal was redesigned to meet the above requirements and an additional 3000 items fabricated and shipped to RVN for re-evaluation.

TASK NUMBER: 06-C-69

TITLE: Explosive Detector - Plasma Chromatography Technique

AUTHORIZED FUNDING: \$134,363

TASK DURATION: 20 August 1968 to 22 July 1970

CONTRACTOR: Franklin GNO Corporation

DESCRIPTION AND RESULTS: This task was to design, build, evaluate and field test a prototype explosive vapor detector based on the principle of plasma chromatography (electron capture). The system was modular in construction and primarily composed of "Off-the-Shelf" items. This effort was basically a feasibility program to determine if a useful detector system could be developed from this technique which would be both specific and sensitive to explosive vapors.

Laboratory and field tests were completed. The program was considered successful and a follow-on program was initiated to design and fabricate a militarized model for user evaluation (04-C-70).

B-363

TASK NUMBER: 07-C-69

TITLE: Grenade, Smoke, Liquid, Non-Hazardous

AUTHORIZED FUNDING: \$64,562

TASK DURATION: 22 August 1968 to 27 March 1970

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The feasibility of a grenade which can be hand or aircraft dispensed, which upon functioning, will produce an essentially instantaneous white smoke on land or over water was demonstrated. The grenade contains a liquid organometallic smoke formulation which is non-irritating, non-toxic, non-corrosive, stable and less dependent on humidity and temperature than either FM or FS liquid smoke agents. The grenade as designed is similar to the conventional M-18 series smoke grenades in size and configuration.

One hundred and twenty-five units were fabricated for test. All toxicology studies applicable to the grenade fill were completed and were most favorable. The results of all work accomplished including the toxicity evaluation of USALWL liquid smoke agent designated 90207-98 were submitted to AMC as a candidate screening smoke agent to replace FS and FM.

B-364

TASK NUMBER: 08-C-69

TITLE: Tree Felling Kits

AUTHORIZED FUNDING: \$30,551

TASK DURATION: 29 August 1968 to 1 October 1969

DESCRIPTION AND RESULTS: A technique was developed for clearing of large diameter trees from land. A plastic explosive, DETASHEET, already approved and in military use, is inserted into a slot, or slots, cut into the trunk of the tree and initiated by means of a conventional detonator. The method proved feasible and prototype tree felling kits were designed and fabricated for OCONUS tests. The kit contains sufficient "DETASHEET" to fell 20, two foot diameter trees.

Four complete kits were evaluated in Panama with excellent results. No additional kits were fabricated after the Panama trials. All the required material is available to user personnel in standard and special purpose demolition kits.

B-365

TASK NUMBER: 09-C-69

TITLE: Revetment Preservation Technique

AUTHORIZED FUNDING: \$26,851

TASK DURATION: 16 October 1968 to 24 April 1970

DESCRIPTION AND RESULTS: Revetments, bunkers and similar fortifications constructed in SEA with sandbags are subject to rapid deterioration from weathering and require frequent maintenance and/or replacement. A water soluble emulsion consisting of sodium polyacrylate (89%), sodium silicate (4%), Cab-O-Sil (5 gm/gal), and colorant is applied to the external portion of the structure to inhibit degradation. The formulation is applied at the rate of one gallon per 100 sq. feet. Two coats are recommended for optimum results. Conventional paint spray equipment is used to apply the protective coating.

All CONUS testing was completed in Jan 70. One complete system was shipped to RVN on 5 Mar 70, consisting of 500 gallons of preservative and one complete spray assembly for operational evaluation.

B-366

TASK NUMBER: 10-C-69

TITLE: Front Line Trace Marker

AUTHORIZED FUNDING: \$35,060

TASK DURATION: 7 November 1968 to 10 September 1969

CONTRACTOR: Madigan Electronics Corporation

DESCRIPTION AND RESULTS: The "Front Line Trace Marker" is a signaling device that utilizes electroluminescent tapelights and which can be rapidly deployed by ground elements to designate their boundaries to aircraft.

This device consists of two electroluminescent tapelights and a power source. These tapelights are juxtapositioned and encased in a panel which employs a waterproof, rot-resistant canvas as backing and a clear vinyl plastic for pockets. A connector emanating from both tapelights provides a waterproof connection with the source. The power source consists of a cylindrical plastic case in which is housed a solid state inverter circuit and four "D" cell batteries capable of delivering 100 V, 400 Hz to the tapelights. The power source is capable of operating in both steady state and flashing mode.

One-hundred ten markers were delivered to this Laboratory during the 1st Qtr FY70. Ten markers were used for CONUS testing while 100 markers were shipped to RVN.

TASK NUMBER: 11-C-69

TITLE: Personnel Marker Grenade (RC)

AUTHORIZED FUNDING: \$81,809

TASK DURATION: 27 February 1969 to 23 April 1971

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: This is a hand thrown, non-lethal, non-toxic, non-irritating, non-explosive device which, when actuated, covers a small group of individuals with an innocuous liquid which is uniquely colored and easily recognizable. The liquid contained in the device consists of a food coloring dye, glycerine (to prevent freezing), and water. Emission time for the marking liquid is approximately two seconds. The device is the size of a baseball and is fabricated of a plastic material. Upon fuze initiation, a gaseous reaction occurs pressurizing the contents and causing the device to rupture at designated areas. These areas, called rupture points, have a wall thickness appreciably thinner than other areas and are symmetrically located on the surface of the device. The effect upon pressurization is dissemination of the innocuous marking agent.

The devices were demonstrated and successfully evaluated by potential users at Fort Belvoir, Virginia. Should marker grenades of the type described be required, production could commence 90 days from award of contract.

B-368

TASK NUMBER: 12-C-69

TITLE: Characterization of Effluvia from Cannabis

AUTHORIZED FUNDING: \$35,267

TASK DURATION: 9 April 1969 to 5 March 1970

CONTRACTOR: IIT Research Institute

DESCRIPTION AND RESULTS: A basic study of the effluvia from four forms of cannabis was performed and analyzed by high resolution gas chromatography. The generalized patterns developed from the study were evaluated to isolate the general properties of the cannabis effluvia. Characterization of the effluvia from the four forms were made and delineation of the similarities and differences were tabulated.

TASK NUMBER: 01-C-70

TITLE: Man-Portable Pyrotechnic Searchlight

AUTHORIZED FUNDING: \$297,829

TASK DURATION: 8 August 1969 to 29 May 1973

DESCRIPTION AND RESULTS: The pyrotechnic searchlight, intended for perimeter defense, utilizes the flame produced by burning oxygen and aluminum powder to produce high intensity illumination. The luminous intensity of the flame produced is of the order of 325,000 candles. By placing a simple parabolic reflector behind the flame, the intensity can be increased by a factor of ten.

The system consists of an oxygen supply, an aluminum powder supply, a torchhead and the associated connectors and valves. The aluminum powder is contained in a hopper and the oxygen is contained in a small tank 33" high by 15" in diameter. Ignition is accomplished electrically by means of a spark gap. The system also includes a collapsible parabolic reflector with a six-inch focal length. Total system weight is approximately 90 pounds and high intensity illumination is produced for 20 minutes.

A portable aluminum/oxygen searchlight was successfully demonstrated. Beam candlepowers of 3.5 million were obtained. Targets could be identified at ranges of 400-500 meters, and target personnel stated that they were illuminated at 1500 meters, even though they could not be seen at the source.

Additional development was completed to provide a hardened system acceptable for military use. This additional work involved the redesign of the aluminum powder hoppers and oxygen containers to provide a quick disconnect capability, and a redesign of the controls for remote operation.

TASK NUMBER: 02-C-70

TITLE: Personnel Detector XM-3 Plus Navigational Capability

AUTHORIZED FUNDING: \$77,648

TASK DURATION: 19 August 1969 to 15 June 1972

CONTRACTOR: General Electric Company

DESCRIPTION AND RESULTS: The U.S. Army Land Warfare Laboratory developed, evaluated and procured for USARV, under ENSURE 235, the first production units of the Detector, Concealed Personnel, Aircraft Mounted, M3. The U.S. Army Land Warfare Laboratory developed a LORAN C type navigation system (HELNAVS) for the UH-1 series aircraft for use in routine aircraft flights. The navigation system displays aircraft position in UTM coordinates. This program was a development and test program to establish that this navigation system could be integrated effectively with the M3 system in an effort to provide a more efficient method for determining "hot spot" locations and hence, increase the efficiency of each intelligence gathering SNIFFER mission. The combined system is modular in construction. The M3 detector output is displayed on a recorder strip chart. The UTM coordinates are visually updated and displayed, as well as printed out on the same recorder strip chart as the M3 detector output.

The recorder/printer interface module with associated hardware was flight tested along with USALWL's M3 and the LORAN C navigation system (HELNAVS) in a UH-1 series aircraft. All modules performed satisfactorily. An improved LORAN C navigation system (designed LRN-102) was designed, developed and fabricated. The new navigator was delivered in late Jun 71. This navigator was integrated with the M3 and recorder/printer and flight tested in Jul 71. Two complete M3 detection and navigation (LRN-102) systems with modular recorder/printer readout devices were evaluated in Jul-Aug 71 by USALWL. The system was evaluated by MASSTER during 3rd Qtr FY72.

B-371

TASK NUMBER: 03-C-70

TITLE: Condensation Nuclei Detection System With Navigation Capability

AUTHORIZED FUNDING: \$650,160

TASK DURATION: 27 August 1969 to 15 June 1972

CONTRACTORS: Litton Systems Inc.; General Electric Company; RAI Research Corporation

DESCRIPTION AND RESULTS: This task was a development program to design, construct and assess a smaller condensation nuclei detector system with an attached navigation system. The total system weighs approximately 130 lbs and is modular in construction. The system has the capability of being mounted and utilized in the following U.S. Army aircraft: OH-58, OH-6A, OV-1B, UH-1 and O-1. The condensation nuclei readout is via strip chart recording. The UTM coordinates are visually displayed as well as printed-out on the same recorder strip chart as the condensation nuclei readings.

The condensation nuclei detectors and the recorder/printer were designed, fabricated and delivered to USALWL. These items were flight tested with the LORAN C navigation system (HELNAVS). Two complete detector/navigation systems were field tested during July-August 1971 in conjunction with the M3/navigation system. This system was evaluated by MASSTER in 3rd Qtr FY72 along with the M3/navigation system evaluation.

TASK NUMBER: 04-C-70

TITLE: Explosive Detection, Aircraft Mounted

AUTHORIZED FUNDING: \$264,576

TASK DURATION: 30 August 1969 to 20 December 1971

CONTRACTOR: Franklin GNO Corporation

DESCRIPTION AND RESULTS: An aircraft deployed system was developed to detect the general location of explosive factories in rural and urban areas via the vapor associated with the manufacturing process. Based on prior feasibility study for detecting vapors of explosives, the ion mobility technique offered one of the most sensitive and specific techniques for detecting airborne effluvia of melted explosives. The object of this task was to design, fabricate and field test two military configured, prototype, airborne ion mobility, explosive vapor detection systems. The detector system was designed to give a positive signal when detecting effluvia from melted explosives that contain NO_2 groups, i.e., TNT. The detection systems are designed to be mounted in the UH-1 series aircraft. A field test was conducted with the detection systems mounted in a UH-1 series aircraft and the systems were assessed against a simulated explosive reclamation facility. The results of the field test showed that the system could detect explosive effluvia, in the presence of other contaminating effluvia, when operating on a UH-1 aircraft at operational air speeds. However, it was believed that by modifying the systems, the downwind detection ranges could be increased by decreasing the amount of explosive effluvia adsorption in the sample train.

The detection equipment has been delivered to USALWL and field tested. The design and fabrication of the modification to the effluvia sampling system was initiated and a prototype sample train flight tested. An improved sampling system was fabricated for inclusion with the system.

TASK NUMBER: 05-C-70

TITLE: Standoff Target Acquisition Sensors

AUTHORIZED FUNDING: \$377,205

TASK DURATION: 2 September 1969 to 1 March 1974

CONTRACTORS: Block Engineering; Canadian Commercial Corporation

DESCRIPTION AND RESULTS: Detection of concealed personnel by detecting the effluents of man and his activities has been demonstrated using equipments already in service with U. S. forces in the field. Detection of such effluents is accomplished by sampling and analyzing the effluent plume directly. This sampling places the sampling aircraft well within the firing envelope of small arms and is therefore a hazardous operation. In order to reduce this hazard, means of detecting effluent plumes remotely at a standoff distance were investigated.

A correlation UV absorption-spectrometer was developed commercially for the remote sensing of SO_2 and NO_2 . An IR interferometer was fabricated to assess its utility against effluents of man and his activities in the spectral region from 1-15 microns. During assessment of the UV SO_2/NO_2 correlation spectrometer NO_2 was detected in the exhaust of a small automobile at a range of approximately 500 meters.

A more sensitive UV correlation spectrometer of improved design was tested during the 4th Qtr FY 73 against NO_2 in vehicle exhausts. An IR interferometer was delivered in the 3d Qtr FY 73. Testing of the improved UV correlation spectrometer was completed in June 1973 and the results published in a Technical Note.

Testing of the IR interferometer commenced in the 4th Qtr FY 73. These tests against targets of military interest continued through the 1st Qtr FY 74. A report covering these tests was published in 2d Qtr FY 74.

TASK NUMBER: 06-C-70

TITLE: Electroluminescent Marking System for Nighthawk Helicopters

AUTHORIZED FUNDING: \$3,202

TASK DURATION: 30 March 1970 to 28 August 1970

DESCRIPTION AND RESULTS: The electroluminescent marking system for nighthawk helicopters consists of four green 18-inch electroluminescent tapelights attached to the overhead windows of the UH-1 series helicopter. The lamps are operated from a control box powered by 120V/400Hz aircraft power. The control box contains a simple ON/OFF switch, a rheostat to control light intensity, and a manual flasher switch. A prototype system was successfully tested on a UH-1B aircraft and six additional systems were fabricated and shipped to ACTIV in Aug 70 for evaluation.

B-375

TASK NUMBER: 07-C-70

TITLE: Explosive Detector/Navigation System

AUTHORIZED FUNDING: \$233,104

TASK DURATION: 9 June 1970 to 18 September 1972

CONTRACTORS: Litton Systems Inc.; Franklin GNO Corporation; General Electric Company

DESCRIPTION AND RESULTS: Based on prior contracted feasibility studies for detecting explosives vapors, the ion mobility spectrometer offered one of the most sensitive and specific techniques for detecting airborne effluvia of explosives. A detection system was designed and fabricated for operational employment when mounted in a helicopter. The object of this task was to incorporate, with the detector, a navigation unit which would provide UTM coordinates of the aircraft's location at the time of a detection. Both the explosive vapor detector, interface recorder/printer, and the navigator unit were modular in construction. The navigation system has a manually activated UTM coordinate visual display as well as print-out capability. The detector system contains two sensor heads with appropriate electronics and readout devices. Both the detector signals and UTM coordinates are printed on a continuous strip-chart record.

The detector system was delivered to USALWL, and initially field tested. Certain sampling deficiencies were noted during the field test and attempts were made to correct the deficiencies. The sampling deficiencies resulted in the equipment not being able to accurately acquire a measurable signal when operating from an aircraft. This resulted in the effort being terminated.

B-376

TASK NUMBER: 01-C-71

TITLE: Improved Front Line Trace Marker

AUTHORIZED FUNDING: \$8,076

TASK DURATION: 28 July 1970 to 17 September 1971

DESCRIPTION AND RESULTS: The "Improved Front Line Trace Marker" is a signaling device which can be rapidly deployed by ground elements to designate their boundaries to aircraft. This device consists of a power pack and an electro--luminescent tapelight assembly. The power pack, which contains four standard military "C" cell batteries and a DC to AC solid state inverter, provides an output of 100V, 400Hz to the tapelights. An attempt was made to fabricate this device, however, the contractor declared bankruptcy and the marker was never completed.

TASK NUMBER: 03-C-71

TITLE: Mini-Destruct Grenade

AUTHORIZED FUNDING: \$65,567

TASK DURATION: 10 August 1970 to 8 December 1971

DESCRIPTION AND RESULTS: The mini-destruct grenade is intended for utilization by Army units to all levels to destroy military items of equipment. The item is capable of burning through 1.8 inch steel plate in 7 seconds.

The mini-destruct grenade consists of a plastic case 1.45" in diameter by 1.8" high with a sleeve on one side to accommodate the ignition system. Ignition is accomplished by means of a pull-wire igniter and igniter cord. The device utilizes the hardware and ignition system components developed for the improved version of the XM191-193 Ground Illumination Signal. The incendiary composition is the standard thermite-type mixture used in the AN/M14 Incendiary Grenade. The device was given the designation: XM23 Incendiary Destructor. Engineer design testing of the XM23 Incendiary Destructor was completed and five hundred items were fabricated and shipped to RVN for evaluation.

TASK NUMBER: 04-C-71

TITLE: Air Enrichment Destruction of Documents

AUTHORIZED FUNDING: \$23,007

TASK DURATION: 26 August 1970 to 18 September 1972

DESCRIPTION AND RESULTS: This task was directed toward the total destruction of the contents of a classified security cabinet using oxygen to augment burning. The safe or cabinet containing the destruct device requires a 5/16 inch diameter hole in the rear wall, center and parallel to the surface of the drawer bottom. Oxygen is introduced by means of 1/4 inch OC tubing. The tubing is positioned in the bottom of each of the four drawers of the cabinet. A pyrotechnic igniter device is positioned in the bottom center of each drawer. The wires required for activating the igniter are connected through the oxygen inlet hole to a DC power supply.

Should it become necessary to destroy the contents of the cabinet, the destruct device may be activated without the necessity of unlocking the cabinet. The pyrotechnic igniter is activated and simultaneously oxygen is fed through the bottom of the drawers to promote the complete destruction of documents.

The feasibility of utilizing oxygen to enhance the combustion of documents contained in class 6 security cabinets was established. Tests utilized oxygen introduced at 10 psig pressure. Average time to destruction varied from 18 to 35 minutes depending on weight of consumables. On the basis of tests conducted, it was estimated that approximately eleven pounds of oxygen is required to assist in the combustion of forty pounds of documents.

TASK NUMBER: 05-C-71

TITLE: Snow Stabilization Technique for Helicopter Landings

AUTHORIZED FUNDING: \$54,231

TASK DURATION: 2 September 1970 to 8 November 1971

DESCRIPTION AND RESULTS: The feasibility of a snow stabilization system that will function by dispensing chemicals that promote sintering of snow was investigated. Laboratory investigation indicated that methanol, methanol/water and methanol/water surfactants were effective snow stabilization agents. Limited field trials demonstrated that, at application rates of two ounces per square yard, snow surface bearing capacity increased from seven to one hundred thirty pounds per square ft. Treated surfaces were resistant to air blasts up to 60 miles per hour velocity.

Field trials were conducted to verify the laboratory and limited small area tests. These trials demonstrated the application of the surfactant under field conditions and the capability of the treated snow surface to withstand rotor downwash under normal take off and landing conditions. The system was demonstrated in Alaska in a winter environment during the third quarter FY 73 with favorable results.

TASK NUMBER: 06-C-71

TITLE: Degradation of Steel Structure by Metal Embrittlement

AUTHORIZED FUNDING: \$155,254

TASK DURATION: 20 November 1970 to 1 March 1974

CONTRACTOR: The Franklin Institute

DESCRIPTION AND RESULTS: The details and results of this study are classified
SECRET.

TASK NUMBER: 07-C-71

TITLE: Assessment of Military Applications of UPAC

AUTHORIZED FUNDING: \$51,029

TASK DURATION: 27 November 1970 to 6 November 1972

CONTRACTOR: Unidynamics Phoenix

DESCRIPTION AND RESULTS: The objective of this program was to determine the feasibility of utilizing a radiation polymerized acrylamide for military applications. Applications studied included: (a) water supply interdiction, (b) conditioning of tactical surfaces, i.e., dust or mud stabilization, (c) equipment disablement through disruption of cooling or fuel systems, and (d) POL decontamination.

It was found that the polymerized acrylamide can be successfully used for all of the above applications in varying degrees. It appears to be especially useful for POL decontamination, engine disabling and dust suppression. Denial of standing water supplies is possible, but requires excessive quantities of material. Seventy pounds of UPAC were shipped to MASSTER, Fort Hood, TX to demonstrate its ability as a dust suppressant.

TASK NUMBER: 08-C-71

TITLE: Investigation of Two-Component Chemiluminescent System

AUTHORIZED FUNDING: \$235,568

TASK DURATION: 27 November 1970 to 28 February 1974

DESCRIPTION AND RESULTS: The objective of this program was to investigate the application of a two-component chemiluminescent system, developed under the sponsorship of the U. S. Navy, to Army marking and signalling problems. The chemiluminescent system consists of a solution of an oxalate ester and a fluoror which is activated by a dilute solution of hydrogen peroxide. Packaged in appropriate hardware the light source could be used for drop zone/landing zone marking, airfield, heliport lighting, personnel/equipment marking for paratroop operations, target marking and survival applications.

A chemiluminescent light stick, consisting of a polyolefin tube 5.75 inches long by 0.675 inches in diameter with one tab at each end was designed and tested. The light stick is available in two colors - green and orange. Engineer design testing was successfully completed and a preliminary data package prepared. A Required Operational Capability (ROC) document was prepared and submitted, together with the preliminary data package, to ACSFOR for approval in November 1972.

The feasibility of a 2.75-inch binary chemiluminescent target marker was also demonstrated. Five rounds were delivered from an AH-1G aircraft in August 1972 and produced signals which were visible at slant ranges of 3.5 - 8 miles. Chemiluminescent night target marking was demonstrated in December 1972 during the Cobra Night Experiment Test conducted at MASSTER, Fort Hood, TX. The concept was favorably received and continued development was recommended. Coordination was established between USALWL and the Office of the Program Manager, 2.75-inch Rocket System, and a Required Operational Capability (ROC) document was prepared and submitted to ACSFOR in February 1973.

TASK NUMBER: 09-C-71

TITLE: Rapid Determination of Heroin (Morphine) in Urine

AUTHORIZED FUNDING: \$109,600

TASK DURATION: 27 November 1970 to 25 July 1973

CONTRACTOR: Midwest Research Institute

DESCRIPTION AND RESULTS: The objective of this task was to determine the parameters for making a positive color-change test for detection of heroin or morphine compounds in urine.

A specimen of urine can be checked for morphine compounds within a period not exceeding ten minutes by the use of reagents contained in a small portable kit. Morphine or morphine compounds are present if the reagents produce a positive change in color.

The kit is suitable for field type environment or laboratory use and consists mostly of throw-away items. Preliminary tests indicated the kit is capable of detecting morphine compounds in the body up to 16 hours after introduction. The kit is self-contained, portable, weatherproof, operable from 32°F to 120°F, with a shelf-life of six months.

During July-August 1971, six-thousand kits were deployed to RVN for evaluation. Approximately 600 urine specimens were tested and results compared to conventional analysis, GLC, TLC, and FRAT. As a result of the RVN evaluation, efforts were directed to increase the sensitivity of the kit to less than 1 ug/ml, reduce the analysis time for one specimen from twenty minutes to two minutes, and to improve the color retention of the reaction with morphine to preclude the loss of a positive result.

B-384

TASK NUMBER: 10-C-71

TITLE: DSCS-4

AUTHORIZED FUNDING: \$203,384

TASK DURATION: 27 November 1970 to 1 March 1974

CONTRACTORS: The Franklin Institute; Battelle Memorial Institute

DESCRIPTION AND RESULTS: The details and results of this study are classified
SECRET.

TASK NUMBER: 11-C-71

TITLE: Heroin Particulate Detection by IMS Techniques

AUTHORIZED FUNDING: \$22,880

TASK DURATION: 11 June 1971 to 18 September 1972

DESCRIPTION AND RESULTS: A previous task was initiated to design, fabricate and field test a modular explosive vapor detection system for employment in a UH-1 series helicopter. This task was to determine the feasibility of optimizing and calibrating the ion mobility spectrometer detectors for detecting heroin particulates associated with heroin. The detection system is intended to be used to monitor individuals and vehicles at checkpoints. The design goal of the system was to give a positive signal to the particulates/vapors, be capable of operating at a mobile checkpoint, and weigh not more than 100 lbs.

The initial efforts to detect heroin related particulates and/or vapors were unsuccessful. The operation of ion mobility spectrometer detectors were evaluated and found to require maintenance and modifications prior to continuing this study.

TASK NUMBER: 12-C-71

TITLE: Identification of POL Products

AUTHORIZED FUNDING: \$55,328

TASK DURATION: 23 June 1971 to 25 January 1973

DESCRIPTION AND RESULTS: A technique was needed for identifying pilfered U. S. Government POL products (primarily gasoline and diesel fuel) and to identify the particular installation (supply point) from which the products were stolen.

The additives developed are covert dyes capable of being mixed with POL (primarily hydrocarbon fuels) and capable of being extracted from POL products to give an easily identifiable color in the field.

The additives are dyes dissolved in toluene in the amount of one part by weight of powdered dye to 100 parts of toluene. One gallon of additive dye solution treats 20,000 gallons of POL product.

A kit for extracting color from the inoculated POL product contains samples of six dyes in the extractant (bottom layer), plastic bottles of extractant, a ten milliliter graduate and ancillary equipment for obtaining gasoline samples from various types of tanks and containers. With each kit is a carton of one hundred 120 milliliter plastic shaker-bottles and one gallon extractant solution (enough for 350-400 roadside tests).

The RVN evaluation was completed 7 January 1972. Results were satisfactory and it was recommended that the POL kit become a standard item of issue. An evaluation was completed in Korea in May 1972. Results were satisfactory. The U. S. Army Mobility Equipment Research and Development Center, Ft. Belvoir, VA, was designated Parent Agency for this item. A proposed ROC was submitted to DA for approval in October 1972. The availability and use of the materials and equipment making up the kit are described in DA Technical Bulletin TB 703-2, dated 29 November 1972.

TASK NUMBER: 01-C-72

TITLE: Detection of Narcotics in Luggage

AUTHORIZED FUNDING: \$3,648

TASK DURATION: 21 July 1971 to 22 March 1972

DESCRIPTION AND RESULTS: The objective of this task was to evaluate the effectiveness of biosensors for the detection of heroin concealed in luggage. If successful, a detection system of this type could be employed at U.S. Customs check points.

Biosensors responsive to vapors from heroin, together with a detector, were being developed for the New York Police Department (NYPD) under a federal grant. The NYPD system consists of a single channel detector containing a positive responding biosensor, and is designed primarily for detecting "cutting rooms", i.e., areas where bulk, relatively pure, heroin is cut to street-grade level.

In order to reduce the possibility of false alarms which could be anticipated in small volume receptacles containing a wide variety of chemical effluents, the detector to be evaluated under this program contained two sensors, one producing a positive response and the other a negative response.

Positive and negative responding biosensors were purchased directly from the developer. The two-channel detector was to be provided on loan for the duration of the test period. Engineering problems with the detector, however, necessitated cancellation of the program.

TASK NUMBER: 02-C-72

TITLE: Narrow Band Imaging in Infrared Spectra

AUTHORIZED FUNDING: \$68,314

TASK DURATION: 19 August 1971 to 19 October 1973

CONTRACTOR: Westinghouse Electric Corporation

DESCRIPTION AND RESULTS: This investigation was to establish the feasibility of detecting the air contamination plumes of man and his activities by attempting to produce an image formed by the absorption of light over a very narrow band width, corresponding to the absorption frequency of gaseous contaminants associated with man and his activities. The investigation covered the spectral range from about 1 to 14 microns in the infrared wave lengths.

An initial investigation to define the gases of interest and the preferred wave lengths for absorption was conducted to define the technique by which the imaging of plumes of contamination would be accomplished. Following this initial effort, emission spectra of ammonia at approximately 10.3μ was measured to determine the practicality of that wavelength. Using a liquid nitrogen cooled vidicon tube the emission spectra of methane approximately $3.3\text{-}3.6 \mu$ was imaged at room temperature successfully in the laboratory without illumination. The signals obtained were practically noise free.

TASK NUMBER: 03-C-72

TITLE: Investigation of Military Potential of the Modular IMS

AUTHORIZED FUNDING: \$123,427

TASK DURATION: 25 August 1971 to 19 October 1973

CONTRACTOR: Franklin Institute

DESCRIPTION AND RESULTS: This task was a feasibility study to detect and identify various effluvia of military interest through use of the ion mobility spectrometer (IMS). It was a four part program to: (a) survey chemical effluvia which could be of military interest, (b) determine and optimize the instrument parameters necessary to detect effectively the various effluvia, (c) determine the optimum readout mode for the operational environment, considering the vapors to be determined and their respective I.M. spectra, and (d) evaluate the instrument in the ground mode against selected sources.

The program was completed with the design, fabrication and test of a one man portable ion mobility spectrometer. The unit demonstrated a capability of detecting some military and indigenous explosives and some vapors related to narcotics.

TASK NUMBER: 04-C-72

TITLE: Assessment of Correlation Interferometer

AUTHORIZED FUNDING: \$84,432

TASK DURATION: 25 August 1971 to 13 March 1973

DESCRIPTION AND RESULTS: During 1971, the U. S. Armed Forces experienced an increase in drug abuse. Determination of a wide spectrum of possible drugs by conventional analytical techniques is time-consuming and expensive. A method was required which is capable of rapidly determining the nature of the drug in either bulk form or as a constituent of body waste fluid.

A correlation interferometer uniquely measures the intensity of fringe interference patterns over a relatively wide bandwidth. Because of a large entrance aperture and its capability of examining each and every wavelength throughout the entire time period of scan, the instrument promises a large gain in sensitivity and resolution over conventional techniques with an accompanying gain in the ability to detect and identify drugs and other chemicals. This task assessed the feasibility of fabricating a field instrument to identify and detect drugs in bulk waste fluid.

The correlation interferometer in its present form could not be designed to yield automatic detection and identification of drugs, and this work was terminated.

B-391

TASK NUMBER: 05-C-72

TITLE: Detection and Evaluation by Neutron Activation Analysis

AUTHORIZED FUNDING: \$35,442

TASK DURATION: 30 August 1971 to 15 November 1972

DESCRIPTION AND RESULTS: This task was a feasibility study to determine the practicability of adding trace quantities of inert material to explosives to aid in subsequent detection and/or identification of hidden explosives in luggage, parcels, etc. Mixtures of these trace additives would provide a means of coding the explosive according to material and manufacturer.

The feasibility of the technique was demonstrated. It was found to have a very limited utility for this purpose because of the limited number of materials (3) found which can provide optimum and unique signatures.

TASK NUMBER: 06-C-72

TITLE: Miniature Chemical Torch

AUTHORIZED FUNDING: \$43,500

TASK DURATION: 4 October 1971

DESCRIPTION AND RESULTS: Miniature chemical torches weighing six pounds or less are available which will cut steel 1/2 inches thick and will also cut aluminum. The burning time of these torches average 3 minutes. Ignition is accomplished by a pyrotechnic charge. Other types of chemical cutting torches, specifically the type known as the "burning bar", are also available. In this test optimum parameters for torch design were established and commercially available torches assessed. The objective was to find an existing torch which satisfactorily meets the parameters established, or to determine modifications necessary to bring a selected torch up to the necessary standards.

Both types of torch were assessed by USALWL to determine operational capabilities. The "burning bar" was far superior to the six pound torch in cutting ability. Additional development on the "burning bar" technique was conducted to provide a lightweight (20 pounds or less) cutting system which will function remotely.

TASK NUMBER: 07-C-72

TITLE: Absolute Calibration of Effluvia Detectors

AUTHORIZED FUNDING: \$133,586

TASK DURATION: 5 April 1972

CONTRACTOR: Southwest Research Institute

DESCRIPTION AND RESULTS: The object of this task was to measure the absolute sensitivity of various effluvia detectors in order to determine the proper instrumentation to be proposed for particular military problem scenarios. This information was to be used to (a) establish the capabilities of the various detection techniques in proposed problem scenarios, (b) assist in developing the instrumentation for military problems, and (c) provide guidelines for specifications for the development of the same and/or other types of effluvia detectors. The vapor detectors investigated and calibrated were: (a) Ion Mobility Spectrometer (FIRL), (b) Vapor Trace Analyzer (Hydronautics, Ltd), (c) Mass Spectrometer, including vehicle-mounted and portable versions (Varian Associates), (d) Dual Channel Bioluminescent Detector - two versions differing in electronic circuitry (RPC), (3) Gelignite Detector, Model SA 27 and Model 58 (Ion Track). The sensitivity of each detector was calibrated for at least one chemical compound of military interest. Each detector was also subjected to tests with possible interferences to determine its relative specificity.

TASK NUMBER: 08-C-72

TITLE: Identification of Marijuana and Hashish Smokers

AUTHORIZED FUNDING: \$12,213

TASK DURATION: 7 April 1972 to 27 February 1973

CONTRACTOR: Midwest Research Institute

DESCRIPTION AND RESULTS: The task was directed toward the development of a presumptive chemical test that would enable an investigator to determine if an individual is using or has recently used marijuana or hashish. The test would also be used to identify raw marijuana or hashish.

Feasibility studies showed that chemical colorimetric tests can give positive indication of the smoking of marijuana or hashish by an individual. Similar techniques can be used to permit the identification of marijuana or hashish in raw form. An expendable kit and technique were developed to permit identification in the field of raw marijuana and hashish and recent smokers of these materials. The kit was offered to interested agencies for an operational evaluation.

TASK NUMBER: 09-C-72

TITLE: Camouflage Through Reflectance of the Natural Environment

AUTHORIZED FUNDING: \$15,317

TASK DURATION: 21 April 1972 to 11 May 1973

CONTRACTOR: General Electric Company

DESCRIPTION AND RESULTS: This task proposed to utilize reflected natural images to hide the presence of military targets from direct frontal visual reconnaissance. The general approach was to design, fabricate and test a light-reflective surface which could be emplaced in front of the item to be hidden in such a manner that the surface reflected the natural surrounding terrain/vegetation. During the conduct of this program, consideration was given to (a) one-way visibility of the reflective surface, (b) sun glare, (c) ease of emplacement, and (d) geometry of the surface. Two full size reflective surfaces (optical shielding devices) were fabricated to demonstrate the feasibility of the approach.

A limited field test was conducted at APG to determine the effectiveness of this camouflage technique. The optical shields reflect the natural terrain in front of a 1/4 ton truck, and render the vehicle invisible or undistinguishable to the unaided eye, under certain conditions, at a range of one half kilometer or more. The two units were delivered on 1 August 1972 to MASSTER at Fort Hood, Texas for a field demonstration.

B-396

TASK NUMBER: 22-C-72

TITLE: Camouflage Applications of Low Density Urethanes

AUTHORIZED FUNDING: \$41,250

TASK DURATION: 21 April 1972 to 1 March 1974

DESCRIPTION AND RESULTS: The objective of this test was to provide field personnel in both forward and rear areas with a camouflage capability which will enhance the security of U. S. Army units through denial of information to enemy surveillance. The approach investigated was the application of foamed urethanes under field conditions at temperatures as low as 0°F utilizing equipment and materials which can be employed at the company level. Specifically, low density (2 pounds per cubic foot) urethanes with color pigments added at time of application were applied to various types of military equipment and installations. Urethane resin components and two portable spraying units were purchased for evaluation. Techniques were evolved for producing camouflage patterns in the field. Methods for incorporating camouflage colors were investigated. A demonstration of the technique at MASSTER, Fort Hood, was conducted in July 1973.

TASK NUMBER: 01-C-73

TITLE: Snow Stabilization Technique for Helicopter Landings

AUTHORIZED FUNDING: \$39,245

TASK DURATION: 14 July 1972 to 1 March 1974

CONTRACTOR: Franklin Institute

DESCRIPTION AND RESULTS: The feasibility of a snow stabilization system that will function by dispensing chemicals that promote sintering of snow was investigated. Laboratory investigation indicated that methanol, methanol/water and methanol/water surfactants were effective snow stabilization agents. Limited field trials demonstrated that, at application rates of two ounces per square yard, snow surface bearing capacity increased from seven to one hundred thirty pounds per square ft. Treated surfaces were resistant to air blasts up to 60 miles per hour velocity.

Field trials were conducted to verify the laboratory and limited small area tests. These trials demonstrated the application of the surfactant under field conditions and the capability of the treated snow surface to withstand rotor downwash under normal take off and landing conditions. The system was demonstrated in Alaska in a winter environment during the third quarter FY 73 with favorable results.

TASK NUMBER: 02-C-73

TITLE: Rapidly Emplaced Barriers

AUTHORIZED FUNDING: \$120,609

TASK DURATION: 14 July 1972 to 1 March 1974

CONTRACTOR: B. F. Goodrich Company

DESCRIPTION AND RESULTS: This task provided for development of portable, rapidly emplaced, barriers. These are inflatable and modular in construction. The barriers will be used to deny access to areas or to channel movement of people. Chemical deterrent or identification agents could be used to man the barriers at check points, but the number of personnel required will be reduced.

The barriers are about 8 to 10 feet high, constructed in 15 foot long modules with a strong fire resistant finish and have an inner bottom reservoir on the front and rear wall, to be filled each with 1,000 pounds water to give the barrier weight and location stability. The 15 foot module in collapsed configuration weighs 300 pounds plus a separate 190 pound rubber coated, puncture resistant, shield with a slippery surface to deter scaling. Inflation to 1 psi nominal pressure is accomplished in less than one minute by using commercially available air cylinders, after the barrier has been rolled out from its aluminum carrying pole.

Configuration/test prototypes have been fabricated and satisfactorily demonstrated. Although further design efforts on the protective shield must be pursued to achieve a maximum resistance capability against penetration from sharp implements, approval has been granted to the contractor to initiate fabrication of the final prototype barriers.

TASK NUMBER: 03-C-73

TITLE: Addicts Identification Kits

AUTHORIZED FUNDING: \$42,149

TASK DURATION: 20 July 1972 to 1 March 1974

CONTRACTOR: Midwest Research Institute

DESCRIPTION AND RESULTS: The addicts identification kit is a small handheld test kit employing three separate reagents. The test operator can test a small amount of urine for cocaine, amphetamines and barbiturates of interest. The kit is suitable for a field type environment or laboratory use and is made up of throw-away items. The technique requires approximately thirty minutes for test of the three compounds. The kit weighs approximately six ounces. The kit is designed to be self-contained, portable, weatherproof and operable from 32°F to 120°F with a shelf life of six months.

B-400

TASK NUMBER: 03-C-74

TITLE: Chemical Patient Blanket Preheater

AUTHORIZED FUNDING: \$20,000

TASK DURATION: 15 February 1974

DESCRIPTION AND RESULTS: The objectives of this task, which was just underway at termination, are: (a) To design and evaluate means of packaging chemical heat generating materials activated by air (as organometallics) or water. (b) To design and evaluate a material which can be activated to generate heat rapidly and safely. The specific goal is to supply adequate heat to preheat a rescue blanket to minimize thermal shock and make a patient comfortable in sub-zero weather, thereby augmenting his self generated body heat and available protective clothing. (c) To design and fabricate a simple blanket preheater which will raise blanket inside temperature from -50°F to at least 70°F in less than 15 minutes.

TASK NUMBER: 24-C-74

TITLE: Aerosol Explosive Indicator Kit (NEOD)

DESCRIPTION AND RESULTS: The object of this program was to develop an explosive detection kit using reagents (explosive indicators) which can be sprayed on a suspected item from a freon propellant-type aerosol can. These indicators, upon coming in contact with the presence of trace quantities of explosives, are intended to change color instantaneously.

A supporting services work order was prepared to Franklin Institute Research Laboratory for performing the task. A request was prepared to Army Research Office, Durham for supporting technical services in very specialized areas of technology in support of this task. Coordination with the Feltman Research Laboratory, Picatinny Arsenal was initiated for program monitoring.

TASK NUMBER: 25-C-74

TITLE: Extendible Vehicular Camouflage Paulin (MERDC)

DESCRIPTION AND RESULTS: The objective of this task was to design, fabricate, document and field test a prototype, extendable, vehicular camouflage paulin (tarpaulin) for an Army truck. Available camouflage material was used to fabricate a camouflage paulin for a 2-1/2 ton Army truck. The system concept was to replace the existing canvas top on the current vehicles with the camouflage paulin which, when deployed, completely covers the parked vehicle.

B-403

TASK NUMBER: 01-P-63

TITLE: Personnel Detector (Electronic)

AUTHORIZED FUNDING: \$63,588

TASK DURATION: December 1962 to 29 April 1965

CONTRACTORS: Electronics Command; Kollsman Instrument Corporation

DESCRIPTION AND RESULTS: Study the potential of utilizing the "Radar Cross-section" of a stationary human as a basis for detecting ambushes in dense vegetation. The item required was a device weighing twenty pounds or less, which could detect the presence of stationary personnel hidden in vegetative clutter at all ranges up to at least 90 meters (essential). LWL investigated two approaches:

1. A Short-Pulse (nanosecond) approach
2. An FM-CW swept-frequency system

A small program of short pulse radar measurements was performed on contract. The results obtained indicated that personnel detection was marginal. Any successful hardware development will require additional fundamental work on the signature characteristics of man and on techniques to discriminate man from clutter.

Field trials of the FM-CW system were conducted by a second contractor. The range of useful detection of a human in high grass was limited. The system used was swept between 400 and 600 megacycles with a 30° antenna beam. "Clutter" return from high grass limited the range of detection of a stationary man within vegetation.

TASK NUMBER: 02-P-63

TITLE: Low Drain Sensors

AUTHORIZED FUNDING: \$14,885

TASK DURATION: 19 December 1962 to 17 November 1964

DESCRIPTION AND RESULTS: Investigate and develop a family of low-power-drain or self-generating sensors, electronic switches and transducers for application where a sensor must remain active for a long period of time. Intrusion and ambush detection, alarm, clandestine listening and triggering devices are examples of operational uses for such sensors.

Efforts under this task were limited to determining the current state-of-the-art in this field. LWL built up a capability in this area, however, the area was too broad for one LWL task. The skills gained will be applied and incorporated in other tasks.

B-405

TASK NUMBER: 03-P-63

TITLE: Position Locator

AUTHORIZED FUNDING: \$573,652

TASK DURATION: 19 December 1962 to 15 January 1968

CONTRACTORS: Ford Instruments; Martin Marietta

DESCRIPTION AND RESULTS: Investigate the feasibility of developing a device to enable friendly forces to locate themselves with respect to other known locations. The device was to be a self-contained man-pack unit weighing 10 pounds or less, having an operational life of 40 hours or more before battery recharge, and having an accuracy within 1% of distance traveled.

The technical feasibility of a Position Locator, reading in map coordinates, was established by LWL field tests. LWL prepared a draft proposed SDR which was staffed.

TASK NUMBER: 04-P-63

TITLE: Communication by Mechanical Earth Waves

AUTHORIZED FUNDING: \$13,409

TASK DURATION: 13 December 1962 to 17 November 1964

DESCRIPTION AND RESULTS: Investigate possible techniques for transmitting and receiving information by use of mechanical earth waves. This task has applications of both signalling and detection.

A study was made of the theoretical and practical parameters associated with elastic wave phenomenon. This study was directed to seismic signalling and communication in limited war environments. It was concluded that both long-and short-range seismic communication and signalling are feasible, but that the technique is subject to many limitations inherent in tropical environments and must be studied in greater detail. These techniques require power levels and equipment weights beyond the limits considered desirable for limited war application. Consequently, the task was terminated.

B-407

TASK NUMBER: 05-P-63

TITLE: Non-Electric Projector

AUTHORIZED FUNDING: \$436

TASK DURATION: 19 December 1962 to January 1964

DESCRIPTION AND RESULTS: Investigate the feasibility of developing a light-weight, non-electric projector for use in under-developed areas.

This project was cancelled. State-of-the Art techniques do not provide a sufficient advantage over electric systems.

B-408

TASK NUMBER: 06-P-63

TITLE: Communication by Earth Currents

AUTHORIZED FUNDING: \$381

TASK DURATION: 13 December 1962 to January 1964

DESCRIPTION AND RESULTS: Determine the feasibility of utilizing earth currents (audio or low-frequency RF) as a means of communication.

Present techniques are not sufficient to provide communication ranges adequate for use in an operational system. The project was cancelled.

TASK NUMBER: 07-P-63

TITLE: Ultrasonics

AUTHORIZED FUNDING: \$26,833

TASK DURATION: 13 December 1962 to 30 June 1964

DESCRIPTION AND RESULTS: Investigate the utility of ultrasound in limited war situations. Experimental "silent" ultrasonic signalling and sensing devices will be investigated.

Two types of ultrasonic "translators" or converters were fabricated. These devices translate an ultrasonic band of frequencies to the audible region. Frequencies of operation for the two systems are 40 KC and 27 KC. A silent-signalling-unit for the 27 KC region has been designed and fabricated. All units are lightweight, self-contained and long lived on internal batteries.

TASK NUMBER: 08-P-63

TITLE: Acoustic Detection System

AUTHORIZED FUNDING: \$1,254,769

TASK DURATION: 6 March 1963 to 8 May 1969

CONTRACTORS: Westinghouse Electric Corporation; Thiokol Chemical Corporation

DESCRIPTION AND RESULTS: Research and development of a helicopter, bullet-warning system. The basic concept of an acoustic locator system was proven in the initial feasibility studies. This concept used the ballistic shock wave from the projectile to warn the aircraft personnel that they are being fired upon, and it used the muzzle blast from the weapon to indicate the direction to the source of fire.

Prototype models of the system were evaluated in RVN in 1967. Deficiencies noted during this evaluation were corrected and verified during testing at APG. Five systems were offered to RVN for continued evaluation, but USARV determined that the requirement for this type of system aboard a UH-1 is no longer valid. The ENSURE was also cancelled. The U. S. Army Electronics Command is the designated parent agency for this task.

B-411

TASK NUMBER: 10-P-63

TITLE: Acoustic Telescope

AUTHORIZED FUNDING: \$24,927

TASK DURATION: 10 April 1963 to 16 September 1965

CONTRACTOR: Electro-Voice Inc.

DESCRIPTION AND RESULTS: Evaluate techniques to enhance the hearing senses of friendly forces. A lightweight, sensitive, directional sound sensor could be usefully applied to surveillance, ambush detection and covert listening. A system was developed and tested by LWL. A draft SDR was prepared and Military Potential testing was conducted at Fort Bragg, North Carolina, on two prototypes.

TASK NUMBER: 11-P-63

TITLE: Forest Sound Spectrum Analysis

AUTHORIZED FUNDING: \$93,252

TASK DURATION: 10 April 1963 to 26 March 1965

CONTRACTOR: General Electric

DESCRIPTION AND RESULTS: Determine the frequency spectra and patterns, throughout the audio region, of naturally occurring sounds in jungle environments. Studies and evaluation will be made of the changes in background signature as a result of disturbing influences; i.e., people, animals, etc.

Recordings of natural sounds made in the jungles of the Panama Canal Zone were analyzed on a frequency, time and source basis. The results showed that the calls of a few birds could indicate intruders, but reliable indicators of hiding personnel were not found.

TASK NUMBER: 01-P-65

TITLE: Improved Airborne Bullet Detector

AUTHORIZED FUNDING: \$119,909

TASK DURATION: 3 August 1964 to 17 May 1967

CONTRACTOR: Norden Division, Aerojet-General Corporation

DESCRIPTION AND RESULTS: The purpose of this task was to investigate the feasibility of detecting the infrared radiation from the muzzle flash of weapons to locate the source of small arms fire. Basic measurements on the IR spectral radiation from several weapons were obtained. A system for demonstrating feasibility was fabricated and evaluated. This system consisted of multiple cells looking at fixed fields of view below the aircraft. Each cell views a 30° azimuth by 30° elevation field below the aircraft. The evaluation of this work showed that small arms radiate sufficient IR energy to be detected at usable ranges.

TASK NUMBER: 02-P-65

TITLE: RR Ambush Detector

AUTHORIZED FUNDING: \$547,845

TASK DURATION: 3 August 1964 to 30 June 1968

CONTRACTOR: Westinghouse Electric Corporation

DESCRIPTION AND RESULTS: This system will detect disturbances ahead of a moving train in the ballasted area of a railroad track caused by the "digging in" of an explosive charge, removal of rails or track obstacles. The track ballast, adjacent to the sides of each rail, is sprayed with a camouflaged ultraviolet-fluorescent paint. A lightweight, self-powered railroad vehicle is operated ahead of the train by remote control from the locomotive. This vehicle is equipped with a system to excite the fluorescent material in the paint and a sensor system to detect a significant change caused by a disturbance in the sprayed area. Alarm signals are radioed to the locomotive from the remote vehicle to indicate disturbances on the right or left rail as well as a barrier or derailment.

Information obtained by the RAD System and provided to an operator in the locomotive is intended primarily for use by Military Railway Security personnel and experienced train crews. The disturbance area is physically marked and offensive action is required thereafter to investigate the potential ambush situation.

Three RAD Systems arrived in RVN during 1st Qtr FY68 for an operational evaluation on the Vietnamese Railway System. A lengthy track defoliation program was required prior to deployment and the evaluation began in 3rd Qtr FY68 and concluded during 4th Qtr FY68. Evaluation results indicated that the RAD concept was not capable of a significant contribution to train security. ACTIV recommended that the RAD System not be used in SEA.

B-415

TASK NUMBER: 03-P-65

TITLE: Binaural Surveillance

AUTHORIZED FUNDING: \$1,986

TASK DURATION: 3 August 1964 to 12 March 1965

DESCRIPTION AND RESULTS: Determine the feasibility of developing a remote, binaural, listening system employing the principle of human binaural hearing and optimizing the advantages of human hearing. If the approach shows promise, various configurations of equipment including remote operation with wire lines and wireless techniques, and signal processing to enhance localization of sound sources will be investigated. The system was found to have only limited applicability to present limited war needs. The task has been terminated.

TASK NUMBER: 04-P-65

TITLE: Document Reproduction

AUTHORIZED FUNDING: \$140,685

TASK DURATION: 3 August 1964 to 19 March 1969

CONTRACTORS: Opto-Graphics; IBM Corporation

DESCRIPTION AND RESULTS: A simple, lightweight duplicator kit was designed and fabricated for use in primitive areas. The kit weighs eight pounds and is completely self-contained. The kit consists of a permanently inked pad which will make 50,000 copies before the ink supply is depleted, a stylus, correction fluid, and a roller. Storage space is provided in the kit for a supply of mimeograph stencils and copy paper. The kit will print onto any paper available.

Fifty kits were fabricated for field evaluation. Thirty seven of these kits were shipped to RVN, five kits to U.S. Army Forces Southern Command (Panama), one to Fort Bragg, and one to Okinawa in Sep 68. The evaluation report stated several shortcomings, all concerning the permanently inked pad and the ink formulation, and make this unfit for use in the RVN environment.

TASK NUMBER: 05-P-65

TITLE: Radio Receiver Neutralization

AUTHORIZED FUNDING: \$64,248

TASK DURATION: 18 June 1965 to 2 July 1968

CONTRACTOR: Motorola, Inc.

DESCRIPTION AND RESULTS: The primary objective of this task was the development of a self-contained neutralizing device that can be installed within a manpack radio which will cause the radio to malfunction after a known time interval. If the radio falls into enemy hands during the "use cycle," operation will cease after a predetermined time; however, if it is retained by friendly forces, it will be returned for a recycling of the timing element.

This type of neutralization is not hazardous to the operator and the timing device operates independently of the radio battery. Timing intervals were investigated that were adjustable in increments of one month up to one year. Radio types considered in this task were the AN/PRC-10A and the AN/PRC-25.

Engineering Development and laboratory test of the final circuitry for the Radio Neutralization System (RNS) was completed for two types of radios. CONUS tests of the RNS under field conditions were completed during the 3rd and 4th Qtrs of FY68.

TASK NUMBER: 06-P-65

TITLE: LASER Backscatter Detector

AUTHORIZED FUNDING: \$27,454

TASK DURATION: 29 June 1965 to 15 September 1966

CONTRACTOR: Melpar Inc.

DESCRIPTION AND RESULTS: This was a study to determine the feasibility of passive personnel detection by the attenuation of backscattered (or reflected) LASER radiation due to the IR absorption of human effluents. This detection system would not only indicate the presence of a person but would also give the direction to the concealed person and possibly even the range. This study considered the concentration of effluents, the absorption spectra of effluents, the LASER wave lengths available, the background and environmental problems, and the state-of-the-art limitations in relation to the total system.

B-419

TASK NUMBER: 01-P-66

TITLE: Stabilized Optical Sight

AUTHORIZED FUNDING: \$103,047

TASK DURATION: 6 July 1965 to 18 April 1969

CONTRACTOR: Bell & Howell

DESCRIPTION AND RESULTS: The device is a monobinocular, i.e., a single entrance lens with two eyepieces. The image is stabilized between the frequencies of 1/2 to 50 cps by means of a gyrostabilized optical element but will also allow the observer to scan. Three different configurations have been fabricated - fixed 7 power magnification, variable magnification (zoom) of 2-1/2 to 10 power, and fixed 7 power monocular (single eyepiece). A lightweight power pack is carried on the belt and uses either a battery or the aircraft 28 V supply.

Five devices were fabricated by the contractor and delivered to LWL. Tests conducted by LWL indicated that the devices did not adequately compensate for the vibration present in the UH-1.

B-420

TASK NUMBER: 03-P-66

TITLE: Mass Spectroscopic Detection

AUTHORIZED FUNDING: \$65,609

TASK DURATION: 18 November 1965 to 14 December 1968

CONTRACTOR: Varian Associates

DESCRIPTION AND RESULTS: A study was conducted to determine the feasibility of the mass spectrometer to detect and discriminate among various human effluents with the ultimate goal of employing this or similar techniques to detect concealed personnel.

The feasibility study was completed with very favorable results. The study indicated that a human signature does exist in the mass spectrum and that it should be detectable with the aid of a newly developed separating filter.

B-421

TASK NUMBER: 05-P-66

TITLE: Infrared Marker

AUTHORIZED FUNDING: \$55,685

TASK DURATION: 28 January 1966 to 23 January 1968

CONTRACTOR: HRB-Singer, Inc.

DESCRIPTION AND RESULTS: The IR Marker is a small (4" dia x 2-1/4" high), lightweight (.9 lb) source of intense, short wavelength IR energy. The system is easily detected by the IR equipment used in U. S. Army Mohawk aircraft. The IR Marker can be used to securely mark the location of downed airmen, landing zones, drop zones, targets, etc.

Fifteen items were delivered to ACTIV for RVN evaluation in Dec 67. USAAVCOM is the designated parent agency for this task.

B-422

TASK NUMBER: 06-P-66

TITLE: Detection of Men Carrying Rifles

AUTHORIZED FUNDING: \$188,381

TASK DURATION: 22 April 1966 to 19 April 1968

CONTRACTORS: Honeywell; Georgia Institute of Technology

DESCRIPTION AND RESULTS: The purpose of this task was to establish the feasibility of and system design criteria for a VHF Detection Radar. A transistorized, man portable VHF radar was fabricated and successfully tested in the Florida Everglades and the jungles of Panama. This system demonstrated the feasibility of detecting moving targets through jungle vegetation at militarily useful ranges.

B-423

TASK NUMBER: 07-P-66

TITLE: Ultrasonic Receiver and Transmitter

AUTHORIZED FUNDING: \$59,406

TASK DURATION: 15 April 1966 to 8 July 1968

DESCRIPTION AND RESULTS: An ultrasonic receiver and transmitter were developed for use in secure short range signaling and as an intrusion detector for ultrasonic energy. The receiver listens to inaudible acoustic energy in the range of 22.7 KHz, converts this to audible signals, and presents this to the listener via earphones. The transmitter generates a 22.7 KHz ultrasonic signal when the ON-OFF button is depressed. The receiver and transmitter are packaged in separate but similar packages 6" x 2-3/8" x 1-5/8", weighs approximately 1 pound each with self-contained battery. One receiver and one transmitter fit into a standard ammunition pouch. Seven systems were shipped to Vietnam in Apr 68 for evaluation. USAECOM was the designated parent agency for this task.

TASK NUMBER: 01-P-67

TITLE: Direction Finding Transmitter

AUTHORIZED FUNDING: \$12,840

TASK DURATION: 27 July 1966 to 8 December 1967

DESCRIPTION AND RESULTS: The basic requirement was for a small radio beacon transmitter, compatible with existing field radios, that could be attached to a dog so his position could be determined by DF'ing. The Direction Finding (tracking) Transmitter developed is a small, battery-operated FM transmitter designed so that it may be readily attached to a dog harness. The unit weighs about 12 ounces with batteries and measures approximately 4.3 inches high by 2.5 inches wide and 1.4 inches deep. Operating on a frequency of 48.6 MHz with a power output of 500 milliwatts, the transmitters are compatible with standard Army ground and airborne FM radios such as the AN/PRC-10, AN/PRC-25, etc.

Three modes of transmission are provided: voice, keyed tone and beacon. When employed on a dog, the beacon mode is utilized and more than 18 hours of continuous transmission for ranges in excess of two miles is possible. The transmitter is mounted on the dog's back using an LWL developed harness made of 1-3/4 inch nylon parachute web.

A loop antenna is provided for use on the receiver that monitors the dog's position. Compatible with the PRC-10 or PRC-25 radio, the DF'ing Loop will give an approximate azimuth to the dog's location. Two receivers can be used to pinpoint the dog's position by triangulation. Six (6) complete systems including transmitter, harness, DF'ing loop and Instruction Manual were shipped to RVN.

TASK NUMBER: 02-P-67

TITLE: Infrared Target Designator

AUTHORIZED FUNDING: \$84,618

TASK DURATION: 16 September 1966 to 16 January 1969

CONTRACTOR: ACR Electronics Corporation

DESCRIPTION AND RESULTS: The Infrared Target Designator is a device for securely marking targets from a helicopter at night. This ITD is capable of being detected and identified by U. S. Army night vision equipment. It can be deployed from a search helicopter equipped with a system for acquiring targets, e.g., low-light level TV. Launching is from an XM23 dispenser (LWL developed item). Gunship helicopters following the search helicopter acquire the ITD using the night vision devices (i.e., starlight scope, metascope), seek out the target and take appropriate action.

Twenty-five units were evaluated in RVN. The item was not considered acceptable due to weight and range limitations. U. S. Army Electronics Command was the designated parent agency.

TASK NUMBER: 03-P-67

TITLE: Tunnel Detection

AUTHORIZED FUNDING: \$533,792

TASK DURATION: 27 September 1966 to 12 May 1971

CONTRACTOR: Varian Associates

DESCRIPTION AND RESULTS: The cesium vapor differential magnetometer is a device which can be used to detect local disturbances in the earth's magnetic field caused by the presence of a tunnel. The magnetometer is easily transportable in a system consisting of three compact units weighing approximately 25 pounds when audio readout is used. The differential magnetometer has a collapsible staff enabling storage of the entire system in a volume of less than 4 cubic feet.

A contract was awarded in FY67 with the objectives of proving feasibility of magnetometer techniques to detect, trace and map tunnels and to determine the specifications for a practical system design. The objectives of this contract were accomplished. A follow-on contract was awarded in FY68 with the objectives of development and fabrication of 12 improved differential magnetometer systems.

An RVN evaluation (January 1969) of a cesium vapor magnetometer revealed an orientation problem between the sensor and earth's magnetic field. Since the Tunnel Detection System employs the same sensor, a modification to eliminate this problem was initiated.

B-427

TASK NUMBER: 04-P-67

TITLE: Airborne Gunfire Locator (IR)

AUTHORIZED FUNDING: \$9,495

TASK DURATION: 21 February 1967 to 25 September 1967

DESCRIPTION AND RESULTS: This task to develop a combined IR muzzle flash locating system and an acoustic detection system to detect and locate small arms fire was cancelled due to funding limitations but then re-established as Task 05-P-68.

B-428

TASK NUMBER: 01-P-68

TITLE: Secure IR Illuminator

AUTHORIZED FUNDING: \$94,757

TASK DURATION: 25 August 1967 to 31 December 1969

CONTRACTOR: Varo Inc.

DESCRIPTION AND RESULTS: The Secure IR Illuminator is a small device for supplying non-visible infrared energy for the starlight scope in those cases when sufficient natural illumination is not available. The illuminator was designed to provide 1/4 moon illumination for four hours at ranges up to 200 feet, and covering the entire field of view of the starlight scope.

Two sizes of illuminators were built and ten of one and five of the other were fabricated for evaluation in Vietnam. Trade-off studies showed incandescent to be a better source than the radiation diodes for this application.

TASK NUMBER: 02-P-68

TITLE: Tunnel Explorer, Locator and Communicator

AUTHORIZED FUNDING: \$61,804

TASK DURATION: 29 August 1967 to 20 January 1969

CONTRACTOR: Westinghouse Electric

DESCRIPTION AND RESULTS: The TELCOM system is a small, lightweight, battery-operated, electromagnetic induction device which can be used as a voice communication link between personnel on the earth's surface and those exploring tunnels. The system also provides a means of locating and tracking the tunnel explorer from the earth's surface and thereby aids the user in mapping the tunnel.

Six TELCOM units were evaluated in RVN. Results: (a) the concept is valid, (b) in present configuration, it is not suitable for use in RVN. Recommendations: Redesign to incorporate the following: (a) reduce size of antenna, (b) incorporate simultaneous transmit and receive function, (c) provide continuous tone for tracking, and (d) longer battery life.

TASK NUMBER: 03-P-68

TITLE: Vapor Surveillance

AUTHORIZED FUNDING: \$1,071,705

TASK DURATION: 23 January 1968

CONTRACTOR: Varian Associates

DESCRIPTION AND RESULTS: Vapor Surveillance is dependent on wind or air currents which form an effluent plume which can be intercepted by the aircraft carrying the detector. This system was developed to detect concealed personnel, explosives, illicit drugs and may be programmed to detect other targets of military interest.

A lightweight, portable detection system incorporating a quadrupole mass spectrometer was designed, fabricated and tested. This system incorporates a sample inlet pump and inlet heater, water scrubber, membrane separator, fore-line vacuum pump, quadrupole analyzer and detector, power supply, PF and DC supply for the quadrupole, vac-ion pump, control and programming electronics and output to data processor and recorders.

A proptotype system was designed, developed and fabricated. Tests were conducted with the system mounted in a ground vehicle and in both fixed and rotary wing aircraft. A smaller, lighter weight, modular detection system for airborne and ground check point applications was then developed and evaluated, primarily for detection of explosives and drugs.

B-431

TASK NUMBER: 04-P-68

TITLE: Land Navigator, AN/PSN-7

AUTHORIZED FUNDING: \$896,321

TASK DURATION: 26 January 1968 to 16 April 1973

CONTRACTOR: Westinghouse Electric Corporation

DESCRIPTION AND RESULTS: The AN/PSN-7 is a completely self-contained, man-carried navigation system that provides the real-time position of its operator by continuously reading out his map coordinates as he walks. No external signals or master stations are required -- the operator sets in his initial coordinates at the start, and the PSN-7 automatically updates these as he walks.

Five Land Navigator AN/PSN-7 systems were developed and tested. All of the contract performance requirements were met, as were most of the contract goals. The highest priority goal of low system weight was bettered by 3 pounds (14 pound goal, 11 pounds achieved). An average accuracy of within $2.5\% \pm 10$ meters CEP of the distance walked was achieved for all systems, with some of the systems actually bettering the "blue sky" goal of accuracy of within 1% by experienced smooth walkers. A 24 hour nominal battery life was achieved.

TASK NUMBER: 05-P-68

TITLE: Airborne Ground Fire Locator (IR)

AUTHORIZED FUNDING: \$908,406

TASK DURATION: 20 February 1968 to 11 September 1970

CONTRACTOR: Barnes Engineering

DESCRIPTION AND RESULTS: The Airborne Groundfire Locator is a device designed to detect and locate the source of small arms groundfire directed at the Cobra aircraft. It uses the IR radiation from the muzzle flash to locate the direction to the source of fire. It uses the acoustic signature from the passing bullet to indicate that the fire has been directed at the aircraft. The IR source location is accomplished by using 28 separate and independent IR detection channels, each detector with approximately a 30° azimuth x 30° elevation field of view; the entire coverage being the hemisphere below the aircraft. The IR will locate sources whether directed at the aircraft or not. The single acoustic sensor detects the ballistic shock wave in the complete sphere around the aircraft.

A prototype model of the system was fabricated and tested aboard the UH-1 and Cobra aircraft. Useful detection ranges (50% probability of detection) were 750 feet for the AK-47 and 2500 feet for the 50 cal machine gun. The false alarm rate was moderately low. Calculations and laboratory measurements indicated that improvements can be incorporated to improve these ranges by a factor of 1.4. Although this increase would allow the detection of the weakest weapon to the minimum range required, pilots did not regard the system as a satisfactory solution and the program was stopped.

TASK NUMBER: 06-P-68

TITLE: Foliage Penetration Radar

AUTHORIZED FUNDING: \$1,689,978

TASK DURATION: 21 March 1968 to 28 August 1970

CONTRACTORS: Syracuse University Research Corporation; Aerospace Research, Inc.

DESCRIPTION AND RESULTS: The LWL Man Portable and Base Defense Ground Surveillance Radars provide the user with the capability of automatically detecting moving targets through dense vegetation and presenting the operator with the range to, and the direction of motion (incoming or outgoing) of the target. The operator is provided with two range gates which can be adjusted independently with a thumbwheel control from range zero to the maximum range of the radar at that location. Target information is displayed both visually with lights and aurally through a headset that enables the operator to listen to range cell activity.

Six man portable and two base defense radar systems were evaluated in RVN. The official evaluation report for the man-portable system states that the radar detects moving personnel through foliage at ranges up to 400m. The report also concludes that the system would be suitable for operational use pending correction of several shortcomings. The U.S. Army Electronics Command was the designated parent agency for this item.

TASK NUMBER: 07-P-68

TITLE: COBRA and LOH Acoustic Locator Investigation

AUTHORIZED FUNDING: \$162,473

TASK DURATION: 3 May 1968 to 8 May 1969

DESCRIPTION AND RESULTS: The purpose of this task is to investigate the feasibility of adapting this system to the AH-1G and OH-6A aircraft.

a. Cobra: The proper positioning of the acoustic locator's sensors on the Cobra is a problem. The best area has been the nose of the aircraft, but the particular mounting technique chosen did not allow satisfactory operation at higher cruise speeds (above 120 knots). Detection of "rotor pop" signals caused a high incidence of false alerts. The conclusion was that the acoustic locator system was not adaptable to the Cobra unless considerable redesign is accomplished.

b. LOH: Noise measurements on the LOH indicated that the acoustic locator system should function in a satisfactory manner on the LOH. However, the requirement for the LOH was rescinded before tests could be performed.

B-435

TASK NUMBER: 08-P-68

TITLE: Detection of Disturbed Overburden

AUTHORIZED FUNDING: \$68,904

TASK DURATION: 6 May 1968 to 20 January 1969

DESCRIPTION AND RESULTS: The local disturbance of the earth's magnetic field caused by disturbed overburden (random reorientation of the soil magnetization) can be detected using a cesium vapor magnetometer. This device is easily transportable in a system consisting of three compact units weighing approximately 22 pounds. The system can be packaged in a volume of less than three cubic feet.

The cesium vapor magnetometer (CVM) was evaluated in RVN during the winter of FY 69. The results of the evaluation indicated that the CVM was effective in the detection of metallic and nonmetallic mines but operationally unsuitable in its present configuration. The USARV recommendations included configuration changes and the elimination of orientation problems peculiar to the CVM when it is operated in horizontal magnetic fields. These recommendations were implemented in Task 12-P-69.

TASK NUMBER: 01-P-69

TITLE: Airborne Foliage Penetration System (Electronic)

AUTHORIZED FUNDING: \$6,383

TASK DURATION: 20 August 1968 to 21 January 1969

DESCRIPTION AND RESULTS: The objective of this task was to determine the feasibility of real-time surveillance of stationary and moving ground targets, completely concealed beneath dense vegetative growth, by means of a VHF radar system mounted on an airborne platform. Surveillance was to encompass the detection, location, identification and evaluation of the target through use of human operator's ability to filter data and control system performance.

The candidate platform would likely be the utility helicopter which possesses the mobility required for the low altitude search mission. Anticipated use of this technique would be by battalion-size ground forces with integral helicopters used for the surveillance role. The program was cancelled by DA after four months due to potential conflict with and duplication of efforts by USAECOM and USAF.

TASK NUMBER: 02-P-69

TITLE: Listening Post Surveillance Device

AUTHORIZED FUNDING: \$221,955

TASK DURATION: 21 August 1968 to 11 March 1971

CONTRACTOR: Aerospace Research, Inc.

DESCRIPTION AND RESULTS: The Listening Post Surveillance Device is a light-weight personnel detector for use by friendly elements responsible for perimeter defense of small mobile units. Its use is primarily intended for foliated areas where unaided LP sentries cannot detect enemy movement beyond 20-50 meters. The effective range of the LPSD is approximately 20-100 meters (in foliage).

The basic system employed by the LPSD is an L-band doppler radar with the frequency centered at 1250 MHz. The range of frequency chosen was such that a degree of foliage penetration can be obtained while realizing a tradeoff for antenna size. Signal processing enables the radar to cope with moving foliage through the use of balanced quadrature techniques and adaptive filtering. With these techniques of processing, optimum probability of detection and minimum false alarms can be obtained under both high and low wind conditions.

Operationally, the LPSD consists of a single unit which can be secured to a tree, mounted on a tripod or positioned on any convenient platform. The field of view encompasses a 60° fan ranging from 20 meters to an open environment maximum range of 120 meters. The fan area-of-coverage is not sharply defined so detections are possible over a complete 180° front with a reduction of detection range. Three LPSD's were deployed to Project MASSTER for test in Jun 70. Five units were sent for RVN Operational Evaluation the 1st Qtr FY71.

TASK NUMBER: 03-P-69

TITLE: Passive Transponder

AUTHORIZED FUNDING: \$86,032

TASK DURATION: 2 September 1968 to 27 February 1974

DESCRIPTION AND RESULTS: This device modulates and reflects back to the radar a portion of the transmitted radar energy, thus providing a simple aid to the identification of personnel. The reflected signal is relatively insensitive to target speed and, because of a distinctive modulation, is recognizable by the radar operator. In addition, a tiny flashing light indicates to the bearer that he is being illuminated by a radar beam. Two models of this device have been built: one for use with the AN/PPS-5 at 16.5 GHz and the other for use with the AN/PPS-4, AN/PPS-6, and General Dynamics 205-B radar sets at 9.5-10.5 GHz.

Six second generation units were tested in October 70 at APG. Transponder range obtained: 1850 meters with PPS-5, 800 meters with General Dynamics 205-B. Twelve more units with radar indicator lights were tested in October 1971. Transponder ranges were the same as above. The radar indicator light range was 5,000 - 10,000 meters with the PPS-5. The antenna on the PPS-5 units was changed from polystyrene to teflon rod for increased ruggedness. A small external audio amplifier was built to increase transponder range, and MASSTER informally evaluated the transponder during the summer of 1973.

TASK NUMBER: 04-P-69

TITLE: Acoustic Azimuth Locator

AUTHORIZED FUNDING: \$109,318

TASK DURATION: 3 October 1968 to 28 January 1971

DESCRIPTION AND RESULTS: The Acoustic Azimuth Locator is a system for locating weapons based upon the sound ranging principle. This system is designed to read out the azimuth to the weapon directly in mils. Azimuths from two or more systems can be used to plot the source location. Each locator is omnidirectional but any combination of eight each 45 degree sectors can be blanked out by use of panel mounted switches. Two events can be stored for readout. With 12 cells, the system will operate for three days. The five systems can be hardwired or radio linked to a Telemetry Display Module (TDM). The TDM is capable of storing the azimuths processed by the systems for readout and plotting at a central location.

The Acoustic Azimuth Locator was designed to be used as a sound ranging system to detect and locate the source of enemy mortar fire directed at a forward area base camp or fire base. It has been found in CONUS tests to be effective at a range of approximately 2000 meters against mortar fire (dependent upon background noise and meteorological conditions).

Five systems and a Telemetry Display Module were sent to RVN on 10 Mar 70 for evaluation by the 5th SF at Ba Xoai (CIDG Camp). The USAECOM was the designated parent agency.

B-440

TASK NUMBER: 05-P-69

TITLE: Discreet Detection of Hidden Weapons

AUTHORIZED FUNDING: \$31,304

TASK DURATION: 9 January 1969 to 18 May 1970

CONTRACTOR: IIT Research Institute

DESCRIPTION AND RESULTS: This was a feasibility study to determine if hidden weapons and munitions can be detected by using the mechanism of non-linear generation of electromagnetic energy and ringdown resonance caused by very short pulses. Although target returns and signatures were obtained, it was felt that a practical system would be too complex for operational use.

TASK NUMBER: 06-P-69

TITLE: Automatic Alarm for Tactical Radar

AUTHORIZED FUNDING: \$90,729

TASK DURATION: 9 January 1969 to 5 January 1970

CONTRACTOR: Aerospace Research, Inc.

DESCRIPTION AND RESULTS: Army tactical radar systems such as the PPS-4 or 5 rely for detection upon substantial operator judgment based on auditory inputs supplied by the radar. While the radar performance is acceptable when operated by a skilled and alert operator under good environmental conditions, non-ideal situations such as wind motion of vegetation, grass, rain, etc., create false alarms that cause rapid operator fatigue and result in the operator missing detections.

New techniques in signal processing resulted in a device which can provide automatic detection and alarm capability for these systems. The device, an adaptive signal processor, automatically adapts to the radar return from wind motion of the vegetation to prevent false alarms and enable the maximum reliable target detection capability for the radar. The adaptive processor connects to the output of the present range gate and does not interfere with the normal operation of the radar. The operator is able to fix a range gate at any range and leave the set. When the target is detected, the alarm light or buzzer goes on, thereby alerting the operator to look at the PPI scope and/or listen to the headset. The PPS-4 can be used in the range scan mode and the PPS-5 can be used in both the range and azimuth scan with this processor.

Three units were evaluated by USARV and were found to be successful in performance and maintenance free. These were put in operational use in RVN. A BOI of 1 per AN/PPS-5 was recommended by USARV. USAECOM was the designated parent agency for this item, and received the complete technical data package.

B-442

TASK NUMBER: 07-P-69

TITLE: Detection of Shrapnel in Logs

AUTHORIZED FUNDING: \$7,306

TASK DURATION: 18 February 1969 to 27 June 1969

DESCRIPTION AND RESULTS: This study was conducted to evaluate possible metal detecting devices to be used outdoors by individuals, scanning each log either on water or in a log stockpile area. Five selected detectors (magnetic and inductive) were evaluated. Reports and recommendations were sent to RVN for nation building application.

TASK NUMBER: 08-P-69

TITLE: Building Surveillance Radar (RC)

AUTHORIZED FUNDING: \$15,527

TASK DURATION: 27 February 1969 to 15 November 1971

DESCRIPTION AND RESULTS: The AN/PPS-14 radar was used as a test instrument to determine the feasibility of using radar for the detection of snipers in buildings. Operationally, surveillance of a particular building could be accomplished from an "across the street" location. Detection of the target is dependent on motion of that target within the building and variables such as distance from radar to building, building construction, number of targets and location of the targets in the building, etc. The PPS-14 was not suitable for operational use in this concept of employment, however, the technical feasibility of this approach was demonstrated.

TASK NUMBER: 09-P-69

TITLE: Identification System (RC)

AUTHORIZED FUNDING: \$15,808

TASK DURATION: 27 February 1969 to 31 December 1969

DESCRIPTION AND RESULTS: Non-linear electrical junctions such as those found in diodes and transistors possess harmonic generating capabilities. When exposed to high intensity electromagnetic fields, these items produce and reradiate signals which are harmonically related to the incident energy. On this basis, small devices possessing junctions can be utilized as unobstrusive markers on tags.

An existing system, based upon this technique, may be able to detect the presence of a tagging item at ranges of up to 100 meters. If the tag has been covertly attached to a person or object, identification should be possible with a high degree of confidence.

Tests were conducted with an experimental system. Results indicated that other elements in the city-street environment possess harmonic qualities which result in the detection of false signals. Limitations are thereby imposed upon the credibility of a detected signal, and the usefulness of this concept of tagging for later identification was less than anticipated.

TASK NUMBER: 10-P-69

TITLE: Radar Intrusion Detector (RC)

AUTHORIZED FUNDING: \$33,318

TASK DURATION: 27 February 1969 to 15 October 1970

DESCRIPTION AND RESULTS: A General Dynamics Model 205 (LWL) radar (an adoption of the AN/PPS-10 radar) was tested in the open and in city type street environments to determine its usefulness for personnel monitoring during periods of curfew. The radar is a doppler system weighing 20 pounds with an automatic alarm and can be operated remotely (by electrical wire) from up to 75 feet away. The radar can be operated in either an "all range" mode or in a range gated mode and can be operated in a fixed azimuth on either automatically or manually scanned. The output of the radar consists of the alerting alarm, the doppler audio signal and the magnitude of the doppler signal.

The radar was tested in a street and in an open environment against walking men targets. The results showed that the ranges are a function of the height of the antenna and the buildings along the street. In a four feet antenna height open area ranges of 700 to 850 meters were obtained and "street" ranges of 600 to 670 meters were obtained. With the antenna 15 feet high, the open area range extended to greater than 900 meters (limit of test area) and the street area range went to 925 meters. The automatic alarm was useful in relieving the operator from the necessity of continually listening to the audio doppler. The operator can distinguish targets by their doppler sounds. A cost analysis showed that the radar was competitive with the cost of personnel to accomplish the same function.

TASK NUMBER: 11-P-69

TITLE: Passive IR Intrusion Detector (RC)

AUTHORIZED FUNDING: \$21,775

TASK DURATION: 27 February 1969 to 7 April 1970

DESCRIPTION AND RESULTS: The differential IR intrusion detector uses a pair of detectors, each having a field of view of 7.5×2.5 milliradians and separated by 1.5 milliradians. A person or other warm body entering the field of view of one of the detectors upsets the balance and triggers an audible and/or visual alarm. Changes in the background affect both detectors and do not cause an alarm. The device is completely passive (does not transmit a signal) and is self-contained including battery. Adaptations of this device could permit counting the passage of persons or vehicles as well as indicating the direction of travel.

Two IR intrusion detectors were evaluated in CONUS and the results show that detection of a single person within the field of view of the device can be made at a range of approximately 300 meters. A number of shortcomings were noted.

B-447

TASK NUMBER: 12-P-69

TITLE: Detection of Buried Targets

AUTHORIZED FUNDING: \$535,039

TASK DURATION: 6 March 1969

CONTRACTOR: Westinghouse Electric

DESCRIPTION AND RESULTS: A capability to detect and discriminate between ferrous and plastic mines (as well as caches) was required. The approach in this task was based upon the premise that discrimination and speed-of-search rather than sensitivity per se are the priorities for this development.

A man portable magnetic/electromagnetic detector which can be used to detect mines and caches was developed. The detector's sensors are an array of fluxgate gradiometers as well as an array of electromagnetic cells. Special filtering and signal processing were used to optimize target pattern recognition characteristics of the detector and enhance target/false target discrimination. The electromagnetic array will be used in a target confirmation role, for wire detection and for increased discrimination. A breadboard fluxgate system was fabricated and successfully tested.

TASK NUMBER: 02-P-70

TITLE: Helicopter Navigation System

AUTHORIZED FUNDING: \$710,306

TASK DURATION: 20 August 1969 to 1 April 1973

CONTRACTOR: Litton Systems Inc.

DESCRIPTION AND RESULTS: The original HELNAVS effort terminated with the successful development and test of a fully automatic LORAN navigation system. This system was assigned the nomenclature - Navigation Set, LORAN, AN/ARN-110 (XLW). Following the initial effort, the equipment was used to demonstrate the application of LORAN to various Army requirements.

A signal survey conducted in the vicinity of Ft. Hood, Texas revealed that LORAN reception was possible. However, during preparation of the coordinate conversion program it was learned that HELNAVS performance would be poor due to the unfavorable location of the area of interest in relation to the LORAN stations. The degradation would show up in repeatable accuracy which would be more than three times worse than that achieved in Eastern CONUS. Also, the antennas were inadequate for the signal strength encountered, thus requiring extensive revision to improve their efficiency before field use is possible. Accordingly, it was concluded that HELNAVS would not be useful in the Ft. Hood area.

During the period of 8-12 Jan 73, LORAN briefings were presented to elements of USARAL at Forts Wainwright, Greeley and Richardson in Alaska. The briefings covered past LWL experiences with HELNAVS and current and future Army LORAN work. USCG plans for LORAN expansion over Alaska were described in an attempt to create a LORAN-awareness within USARAL. This is all that was deemed appropriate in the LWL/LORAN/USARAL area.

Five complete HELNAVS were transferred to the Project Manager for Navigation/Control at Fort Monmouth, NJ to further support the Army LORAN effort. Four other HELNAVS were used by USALWL in other programs.

B-449

TASK NUMBER: 04-P-70

TITLE: Arms Rooms Security (ARROSE)

AUTHORIZED FUNDING: \$29,104

TASK DURATION: 19 June 1970 to 12 June 1972

DESCRIPTION AND RESULTS: The task demonstrated and evaluated a basic system for arms room protection. Various components of commercially available security devices were procured based on previous experience and in-house evaluations and combined into a security system capable of detecting reliability and relaying the information.

The basic item in the system is the AN/PSS-8 ultrasonic radar. The control unit is capable of operating up to twenty external transceivers which provides a multiroom protection installation if desired. The area of protection provided by each transceiver is an elliptical zone with maximum ranges against one walking man between 20 and 40 feet, depending on installation conditions. This detector has a record of zero false alarms in over 1300 surveillance hours of operation while recording over 13,000 detections some under specifically controlled exercises to determine detectability. Accessory items include desk monitors, local audio "burglar alarms" and standby rechargeable back-up power units. Data was obtained from the USALWL operational installation at APG. The recorded false alarm and detection data covers the period of 19 Feb to 26 Apr 71. The systems were operationally evaluated in RVN during the period Oct to Dec 71 with excellent results.

B-450

TASK NUMBER: 05-P-70

TITLE: Advanced Foliage Penetration Surveillance

AUTHORIZED FUNDING: \$1,096,953

TASK DURATION: 25 June 1970 to 1 March 1974

CONTRACTORS: Aerospace Research Inc.; Syracuse University Research Corporation

DESCRIPTION AND RESULTS: The multipurpose foliage penetration (FOPEN) radar is a VHF ground surveillance radar which provides the user with a foliage-independent, all-weather capability for battlefield surveillance. This system has the capability of automatically detecting moving targets, personnel and vehicles, over irregular densely foliated terrain and presenting the operator with the range and azimuth to the target, the direction of target motion (in or out), and the radial velocity of target (low or high velocity indicators).

The multipurpose system consists of a basic, man-portable radar with add-on modules which enable it to be used as either an intermediate range or base station radar. Due to the low operating frequency of the radar, the system is capable of effective performance in any type of vegetation.

The Base Station Radar is intended for long term employment at a fixed installation. This system provides the user with a 1000 to 2000 meter detection capability. The electronics portions of the man-portable and intermediate range radars are identical with those of the Base Station, thus simplifying operator training, maintenance and spare parts.

Four second generation multipurpose FOPEN (M-FOPEN) radar systems were fabricated to correct the shortcomings indicated in an ACTIV report. These included extending the range of the systems and adding a capability of locating targets in azimuth when detected. Two M-FOPEN systems were evaluated by the 25th Inf Div in Hawaii during March and April 1973. A MASSTER representative observed the testing.

B-451

TASK NUMBER: 01-P-71

TITLE: Nuclear Quadropole Resonance for Explosive Detection

AUTHORIZED FUNDING: \$33,478

TASK DURATION: 11 August 1970 to 18 February 1972

DESCRIPTION AND RESULTS: Six characteristic frequencies for RDX were reported in USALWL TR No. 71-07. A system analysis indicated that detections of RDX outside the coil may be possible. More actual measurements are needed in order to improve the analysis. Some of these measurements have been made. However, the program to develop a fieldable instrument was canceled in favor of a similar effort being conducted by the Navy for the Marine Corps.

B-452

TASK NUMBER: 02-P-71

TITLE: Remote Raman for Vapor Detection

AUTHORIZED FUNDING: \$19,754

TASK DURATION: 1 September 1970 to 13 October 1971

CONTRACTOR: Avco Corporation

DESCRIPTION AND RESULTS: A feasibility study was made to investigate the use of laser-Raman spectroscopy for the remote detection of vapors from explosives, vehicle exhausts and other targets of military interest. A laser-Raman system for remote detections consists of a high powered laser to illuminate the vapor cloud, a collector to observe the Raman radiation from the cloud, an optical system to sort the radiation into discrete frequencies and a data processing/display system. If a gated laser is used, the system permits a range-resolved measurement of vapor species and concentration.

Theoretical studies were conducted to determine which of the constituents of vehicle exhausts exhibit a Raman spectra, and computations were performed to show the magnitude of Raman signal returns that could be expected from representative vehicle targets at various distances from the laser source. It appears that the laser-Raman approach is not feasible at ranges in excess of a few meters because of the very small signal returns, even under the most ideal environmental conditions. An alternate approach to the remote detection of vapors may be fluorescence and this was briefly investigated under the task.

TASK NUMBER: 03-P-71

TITLE: Ground FLIR Evaluation

AUTHORIZED FUNDING: \$48,671

TASK DURATION: 20 November 1970 to 12 July 1971

DESCRIPTION AND RESULTS: A device offering the advantage of detection, recognition, safe standoff distance, and a passive day and night capability was needed for perimeter protection. An Air Force "Black Spot" FLIR (Forward Looking Infrared) system was adapted for ground use and evaluated to determine its capabilities for detecting personnel and vehicular targets in open and wooded environments. This system converts IR radiation into a TV type display and has the monitor remotely located from the sensor. The system has a field of view of 45° azimuth by 12° elevation, and can be manually scanned $\pm 360^\circ$ in azimuth. The system's capabilities were compared to a visual observer in daylight or to a starlight scope for night observations.

Tests of the system were conducted against men and jeep targets in an open area and against men targets in a wooded area. Tests at the Aberdeen Proving Ground were conducted in simulated cold environments.

TASK NUMBER: 05-P-71

TITLE: Polycarbonate Lens Caps

AUTHORIZED FUNDING: \$13,097

TASK DURATION: 11 January 1971 to 15 September 1971

DESCRIPTION AND RESULTS: The objective of this task was to investigate the feasibility of using "see-through" lens caps to protect binoculars and optical instruments in sand and dust laden field environments. First consideration was given to polycarbonate lens caps although alternative materials and approaches have been considered. Tests were conducted to determine the validity of utilizing lens caps, the effectiveness of each approach and the improvement attained over unprotected optics. Human engineering aspects and the effect of the caps on the user's effectiveness were considered.

A lens cap holder was designed and fabricated to attach lens caps to standard military binoculars. Dust chamber tests were performed with a variety of materials including sapphire, coated optical glass, optical glass, plexiglass and polycarbonate. Their performance was ranked in that order with the polycarbonate failing completely. A hard coating is now available for the polycarbonate which could change these test results.

TASK NUMBER: 06-P-71

TITLE: IPL Operational Evaluations

AUTHORIZED FUNDING: \$21,844

TASK DURATION: 25 January 1971 to 27 March 1972

DESCRIPTION AND RESULTS: The Improved Position Locator (IPL) is a dead-reckoning, land navigational device designed to be carried and used by a combat rifleman. Operator position is digitally displayed as 8-place UTM grid map coordinates. Position error has been found to be under 3% of distance traveled; e.g., after walking 1000 meters, the IPL operator will know his map coordinates with less than 30 meters error.

Field tests were conducted at Fort Bragg, Hunter-Liggett Military Reservation, Puerto Rico, Philippine Islands, Aberdeen Proving Ground, and Baltimore, Maryland. Results show the IPL meets the accuracy goal of 3% of distance traveled. Five IPL systems were sent to RVN in Oct 69 and were subjected to an operational evaluation by the US Army Concept Team in Vietnam (ACTIV). Results indicate that satisfactory performance was achieved in that accuracy was high, maintenance was low and operator acceptability was outstanding. However, several shortcomings were noted and recommendations for modification were made.

The IPL's were refurbished and two were returned to RVN for special use by the 4th Infantry Division. Three units were evaluated by MASSTER during the period 30 Nov - 18 Dec 70. Results of that evaluation were very favorable for the IPL. A STANO-IPR was held on 13 Apr 71 to determine the future of the IPL within the Army life cycle of development. The most important result of the IPR was a recommendation that a requirement be established for which the IPL would be a candidate item. Additional field tests continue to utilize the IPL. HELBAT II exercises at Fort Hood found the IPL effective in aiding forward observers to accurately locate themselves.

TASK NUMBER: 07-P-71

TITLE: Detection of Submerged Targets

AUTHORIZED FUNDING: \$137,815

TASK DURATION: 8 January 1971 to 1 March 1974

CONTRACTOR: Antenna Research Associates

DESCRIPTION AND RESULTS: The purpose of this task was to determine the capabilities of an electromagnetic system to detect surface and underwater targets such as hostile swimmers. Two different technical approaches were investigated. The first was a radar technique using long wavelengths, i.e., 140 and 915 MHz to detect the swimmer on or just below the surface of the water. Radar cross section measurements at both frequencies were completed and showed that at 915 MHz a swimmer can be detected reliably. The second approach utilizes ELF energy (approx 1000 Hz) to detect a swimmer at close range underwater.

B-457

TASK NUMBER: 08-P-71

TITLE: Mark Stabilized Binocular - Model 1610

AUTHORIZED FUNDING: \$14,924

TASK DURATION: 26 February 1971 to 21 July 1971

DESCRIPTION AND RESULTS: An airborne observer requires an optical aid such as binoculars in order to identify ground targets and conduct surveillance of enemy activities. However, binoculars cannot normally be used due to the vibration present in the aircraft. The Stabilized Binocular incorporates a gyro-controlled optical element which stabilizes the optical image when used in a vibrating environment (aircraft, ship, vehicle). Two sets of the Stabilized Binoculars were delivered to USAREUR for their evaluation.

TASK NUMBER: 09-P-71

TITLE: Combat Air Vehicle Navigation and Vision Study

AUTHORIZED FUNDING: \$11,716

TASK DURATION: 4 May 1971 to 21 July 1971

DESCRIPTION AND RESULTS: At the direction of OCRD, a short intensive study was conducted to define the problems associated with NOE flight at night. The study gave recommendations for reasonably available solutions (3-12 months). Plans were prepared (time, funds availability, etc.) to supply these solutions to MASSTER for their use in Systems Tests (e.g., Air Cavalry Combat Brigade). The study was presented to MASSTER and approved.

Three short term solutions (techniques) were proposed in the study. The first technique involved supplying the pilots with sufficient visible illumination via searchlights to allow them to fly NOE. The second technique involved equipping the pilots with Night Vision Goggles, AN/PVS-5. The third technique involved pilots equipped with NVG plus supplemental IR illumination. Common to all three techniques was equipping the helicopter with HELNAVS (Helicopter Navigation System) and a radar altimeter, AN/APM-171.

Testing proved the feasibility of all three techniques. However, the use of the NVG alone proved the most successful. MASSTER was provided with training and sufficient assets to equip fifteen aircraft. An evaluation was completed and the technique is now being used in other operational tests at MASSTER. The Experimental Command for USACDC was also provided with training and assets for evaluation of the CAVNAV technique for night low level operations.

TASK NUMBER: 10-P-71

TITLE: MASSTER - Acoustic Locator System

AUTHORIZED FUNDING: \$7,565

TASK DURATION: 13 May 1971 to 1 June 1972

DESCRIPTION AND RESULTS: This task was established to support a MASSTER evaluation of the USALWL's Acoustic Locator System (former Task 08-P-63). The Acoustic Locator is an acoustic airborne device that detects groundfire and indicates the azimuth and evaluation of the source of fire. The system utilizes the ballistic shock wave from the passing projectile to detect the groundfire and then indicates the direction to the source of fire using the muzzle blast signal from the weapon. Readout is accomplished in a Polar Position Indicator (PPI) type format on two cathode ray tubes, one for the pilot and one for the copilot. LWL tests have shown that the systems perform satisfactorily on the UH-1, but are unsatisfactory when used on the Cobra.

The evaluation was conducted at MASSTER during Nov-Dec 71 and the test report was published in Mar 72. This report recommended that the development of the Improved Acoustic Locator System, as a means to satisfy a requirement for a bullet detector system, be terminated. It did not address the question of need for airborne groundfire detector sensors.

TASK NUMBER: 11-P-71

TITLE: Cache Detector Evaluation

AUTHORIZED FUNDING: \$13,286

TASK DURATION: 9 June 1971 to 22 November 1971

DESCRIPTION AND RESULTS: The Cesium Vapor Cache Detector (CVCD) is a device which can be used to detect the disturbance of the earth's magnetic field caused by the presence of a cache. The sensor is a cesium vapor total field magnetometer which produces an output frequency which is directly proportional to the ambient magnetic field intensity. Although its basic sensitivity is 1.0 milligamma, a readout resolution of 100.0 milligammas is all that is required in this application.

The four-ft 16.0-lb CVCD system was developed using major subsystems of the eight-ft 25.0 lb Portable Differential Magnetometer (PDM) system which was developed under the USALWL Tunnel Detection Program. Emphasis was placed on the reduction of size and weight. The objective of this task was to modify the PDM systems to produce five CVCD systems for test at MASSTER.

Five CVCD systems were tested at MASSTER during Oct-Nov 71. The MASSTER Test Report indicated that the CVCD was effective in the detection of caches and mines and recommended continued development.

The IPR for the CVCD was held in Jun 72. The pertinent recommendation was for expeditious development by AMC to remove shortcomings and retest.

B-461

TASK NUMBER: 01-P-72

TITLE: Combat Air Vehicle Navigation and Vision

AUTHORIZED FUNDING: \$118,317

TASK DURATION: 14 July 1971 to 5 February 1973

DESCRIPTION AND RESULTS: At the direction of OCRD, a short intensive study was conducted to define the problems associated with NOE flight at night. The study gave recommendations for reasonably available solutions (8-12 months). Plans were prepared (time, funds availability, etc.) to supply these solutions to MASSTER for their use in Systems Tests (e.g., Air Cavalry Combat Brigade). The study was presented to MASSTER and approved.

Three short term solutions (techniques) were proposed in the study. The first technique involved supplying the pilots with sufficient visible illumination via searchlights to allow them to fly NOE. The second technique involved equipping the pilots with Night Vision Goggles, AN/PVS-5. The third technique involved pilots equipped with NVG plus supplemental IR illumination. Common to all three techniques was equipping the helicopter with HELNAVS (Helicopter Navigation System) and a radar altimeter, AN/APM-171.

Testing proved the feasibility of all three techniques. However, the use of the NVG alone proved the most successful. MASSTER was provided with training and sufficient assets to equip fifteen aircraft. An evaluation was completed and the technique is now being used in other operational tests at MASSTER. The Experimental Command for USACDC was also provided with training and assets for evaluation of the CAVNAV technique for night low level operations.

TASK NUMBER: 02-P-72

TITLE: Metabolized Drug Detection

AUTHORIZED FUNDING: \$80,224

TASK DURATION: 16 August 1971 to 6 February 1974

CONTRACTOR: Varian Associates

DESCRIPTION AND RESULTS: Using the spectrometer developed under the related USALWL Task entitled, "Vapor Surveillance," investigations were conducted to determine if analysis could be made in real-time and if analysis could be made without taking a blood or urine sample. This approach could provide both legally admissible evidence for enforcement purposes and specific information for medical treatment purposes. Results have shown that one must use blood or urine samples for rapid determination.

The Drug Detection System consists of the "Vapor Surveillance" spectrometer with a specially designed inlet tube. The system can make rapid determination of the presence of drugs or drug metabolites in blood, urine, or gastric samples. The system will detect opiates, barbiturates, amphetamines, and hallucinogenic drugs. It can monitor the level of drugs administered therapeutically and can detect and identify drug overdoses in samples from comatose victims. The information is given in the form of an oscilloscope trace, a chart recorder record and a teletype printout based on signatures stored in the computer memory.

Tests at the San Francisco General Hospital indicated that this instrument was effective in identifying drugs in urine samples from overdose cases arriving at the emergency room. Further tests confirmed sensitivities at 30 ug/ml level for morphine in urine. Additional tests were run to determine optimum storage parameters for urine samples.

TASK NUMBER: 04-P-72

TITLE: Land Navigator, Vehicular AN/VSN

AUTHORIZED FUNDING: \$194,401

TASK DURATION: 13 September 1971

CONTRACTOR: Westinghouse Electric Corporation

DESCRIPTION AND RESULTS: The problem of utilizing magnetic compass techniques to navigate accurately in tactical vehicles was studied. It is considered essential that any magnetic compensation technique utilized on a tactical vehicle be capable of rapid and accurate recompensation in the field without the use of any external equipment or references. This is necessary in order that changes in load or configuration not interfere with the navigation performance.

The demonstrable prototype developed in this program is a passive self-contained, dead-reckoning vehicle navigation system. The readout display provides 8-digit UTM map coordinates which instantaneously and continuously up-dates the present vehicle position. Continuous display of heading information is provided to the driver of the vehicle. The system utilizes an odometer input for distance measurement and provides position accuracy to within 3% of distance traveled. Additional error can be incurred in areas where external magnetic disturbances are present. The unique compensation technique employed in the system enables the operator to automatically recalibrate the system in the field if a load change should occur which significantly alters the magnetic signature of the vehicle.

The semi-automatic compensation technique was laboratory and field tested yielding successful results adequate for good navigation performance. Two systems were fabricated. One system underwent extensive field testing with an accuracy of 3% of distance traveled achieved.

TASK NUMBER: 05-P-72

TITLE: Radar Intrusion Detector Support

AUTHORIZED FUNDING: \$2,299

TASK DURATION: 8 October 1971 to 15 April 1972

DESCRIPTION AND RESULTS: A General Dynamics Model 205 (USALWL) radar (a modified AN/PPS-10 radar) was tested in the open and in city type street environments to determine its usefulness for personnel monitoring during periods of curfew as may be imposed during civil disturbances; it is a doppler system weighing 20 pounds with an automatic alarm and can be operated remotely (by electrical wire) from up to 75 feet away. The radar can be operated in either an "all range" mode or in a range gated mode and can be operated in a fixed azimuth on either automatically or manually scanned. The output of the radar consists of the alerting alarm, the doppler audio signal and the magnitude of the doppler signal.

The radar was tested in a street and in an open environment against walking men targets. The results showed that the ranges are a function of the height of the antenna and the buildings along the street. With a four-foot antenna height, open area ranges of 700 to 850 meters were obtained and "street" ranges of 600 to 670 meters were obtained. With the antenna 15 feet high, the open area range extended to greater than 900 meters (limit of test area) and the street area range to 925 meters. The automatic alarm was useful in relieving the operator from the necessity of continually listening to the audio doppler. The operator can distinguish targets by their doppler sounds. A cost analysis showed that the radar was competitive with the cost of personnel to accomplish the same function. The radar was evaluated by the CDC Military Police Agency and found to be useful for civil disturbance and perimeter security applications.

TASK NUMBER: 06-P-72

TITLE: Glare Reduction

AUTHORIZED FUNDING: \$205,137

TASK DURATION: 26 November 1971 to 30 June 1973

DESCRIPTION AND RESULTS: The initial effort on this task was intended to discover whether or not vacuum-deposited optical coatings could reduce the glare from plexiglass helicopter canopies sufficiently to provide a military advantage. Two helicopters were treated with optical coatings and paint on rotor hubs and blades and flown under controlled conditions. Additionally, a computer-aided modeling study was initiated to determine the areas giving the greatest reflection. These approaches to the problem were superseded by an INSURE from MASSTER which resulted in an accelerated program to coat and paint eight AH-1G Cobras and evaluate them at Ft. Hood, TX.

Results from limited informal tests disclosed that the probability of detection of a treated helicopter at 3 kilometers was reduced to 53% from 75% for the untreated helicopter. MASSTER tests measured a 3 to 1 reduction in the amount of reflection from a treated helicopter, but no significant difference was observed with the naked eye. It was concluded that the coating of plexiglass windshields did not provide an important military advantage, but painting of rotor hubs with anti-reflectant paint eliminated those parts of the helicopter as a source of glare.

The task was then reoriented back to the computer-aided modeling work and simultaneous fabrication of a flat-plane canopy which should reduce the frequency of incidents when glare attracts an observer's attention. Given the data from these experiments, it may be possible to construct baffles or other physical disrupters to eliminate specific areas which frequently cause solar reflection. Work on coatings was suspended indefinitely until it was determined whether or not that technique could assist in the total solution.

TASK NUMBER: 07-P-72

TITLE: Moving Platform FOPEN Radar

AUTHORIZED FUNDING: \$686,216

TASK DURATION: 9 December 1971 to 22 March 1974

CONTRACTORS: Syracuse University Research Corporation; Litton Systems

DESCRIPTION AND RESULTS: This program resulted in the fabrication and flight testing of a breadboard system for Army aircraft to detect and classify fixed and moving targets and display them in real time to the operator. A small computer and Fast Fourier Transform (FFT) algorithms are used to sort target returns and display them on a CRT display. This display has fixed and moving target modes as well as ground mapping. Both fixed and moving targets, concealed by foliage, have been detected from the aircraft.

A HELNAVS system is utilized to provide UTM coordinates of the aircraft's position to the radar computer to locate and print out target location for future reference.

Flight tests of a breadboard system in the DC-3 aircraft were completed. The radar was modified for the OV-1 Mohawk configuration prior to further flight tests in the DC-3.

TASK NUMBER: 08-P-72

TITLE: Vapor Detection by Thin Layer Adsorption

AUTHORIZED FUNDING: \$88,119

TASK DURATION: 24 February 1972 to 1 April 1974

CONTRACTOR: Environmental Metrology Corporation

DESCRIPTION AND RESULTS: The objective of this task was to establish critical design parameters for a portable, inexpensive device which will detect explosive vapors and demonstrate feasibility of the concept of thin-film vapor detection. Investigation and experimental evaluation of thin metallic films was conducted, and the most promising films were combined with vapor sample conditioning and elemental detection processing into a simple device for laboratory demonstration.

Ultimate design goal is a low-cost, lightweight/man-portable device, battery-operated with real-time display or visual/audio indicator. Vapor selectivity will be such that the device can be operated reliably in the presence of conflicting background odors. Typical uses would be at vehicle checkpoints, airports, baggage-handling facilities, etc., where reliable, fast surveillance could be performed on a high volume of traffic without creating unacceptable delays.

A prototype demonstration was held at LWL in May 1973, where the unit successfully detected EGDN and dynamite vapors. Several miniaturized devices were built for field evaluation and the prototype continued to be used as a laboratory tool to investigate the detectability of other vapors of military interest.

TASK NUMBER: 09-P-72

TITLE: EM Absorptions

AUTHORIZED FUNDING: \$2,893

TASK DURATION: 8 March 1972 to 13 November 1972

DESCRIPTION AND RESULTS: LWL's former task leading toward the development of the NQR explosive detector was cancelled because of a similar effort being pursued by the Marine Corps with Block Engineering Corp. The development of a "universal" NQR explosive detector was being held back because of the lack of a signature for the NO_2 radical associated with most explosives. This effort investigated a double resonance technique directed toward finding this NO_2 absorption frequency. Results were negative due to instrumentation problems. Funding limitations precluded any additional work on this task.

B-469

TASK NUMBER: 10-P-72

TITLE: Plastic Airplane

AUTHORIZED FUNDING: \$365,042

TASK DURATION: 9 February 1972 to 21 March 1974

CONTRACTOR: Windecker Ind.

DESCRIPTION AND RESULTS: This program provided for radar cross section measurements of a commercially available plastic aircraft to determine if fiber-glass reinforced plastic materials can be used to reduce the radar signature of an aircraft. The additional benefits of this new construction technique such as reduced infrared and acoustic signatures were also addressed.

The infrared measurements and static portion of the radar cross section tests were completed with favorable results. Evaluation of 40 sections of the aircraft by Ft. Eustis established that there is no spalling or crack propagation when aircraft sections are hit with 30 cal, AP and ball, at all angles of incidence. Dynamic radar cross section measurements were done in conjunction with NRL (Naval Research Laboratory) and the sensor package was installed and flight tested.

TASK NUMBER: 11-P-72

TITLE: Coated Windshields for AH-1G

AUTHORIZED FUNDING: \$375,229

TASK DURATION: 8 May 1972 to 25 August 1972

CONTRACTOR: Optical Coating Laboratory

DESCRIPTION AND RESULTS: This task employed "anti-reflection" coatings on AH-1G windshields and supplied eight full sets for evaluation by MASSTER beginning 1 Aug 72. Eight complete sets of reduced reflection canopies were produced, installed on AH-1G helicopters and delivered to MASSTER at Fort Hood, TX. The helicopters into which they were installed were provided by MASSTER and the USA Combat Developments Experimentation Command, Ft. Ord, CA. In addition, the main rotor blades and the rotor hub areas were painted with a reduced reflection paint, produced by the USA Coating and Chemical Laboratory, and the aircraft were flight certified.

TASK NUMBER: 12-P-72

TITLE: Detection of Artillery

AUTHORIZED FUNDING: \$10,498

TASK DURATION: 1 June 1972 to 6 February 1974

DESCRIPTION AND RESULTS: The objective of this task was to present recommendations at the Tri-Service Conference. The following were the recommendations made:

- a. For artillery detection in transit and in camouflage, consideration should be given to increased utilization of Ektachrome Infrared Aero Film (Camouflage Detection).
- b. For artillery detection during firing, weapons systems (FLIR's on hand) could be employed.
- c. A 360° mechanically scanned, low frequency (L-band) radar could provide a rapid interim detection and location ability with moderate accuracy.
- d. Airborne Foliage Penetration Radar and unintentional radiation are long-term approaches.
- e. Simple photographic techniques could provide a coarse, but inexpensive, detection and location scheme.

TASK NUMBER: 13-P-72

TITLE: High Efficiency Antenna

DESCRIPTION AND RESULTS: Long range communications between mobile corps headquarters in Europe are limited in range by the terrain and type of equipment used. In particular, the AN/TRC-110 and AN/TRC-117 assemblages of the Medium Capacity Tactical Radio Relay System utilize a 50-foot (AB-577) antenna mast which is too low to enable communications over sufficient range

In this program an evaluation of the TRC-110 and 117 assemblages was made to determine the characteristics of the equipment and the method of employment. Basic RF field strength measurements were made to determine the effect of antenna height and transmitted power on communication range. Simple techniques such as low loss cable and improved antenna characteristics were investigated to improve the efficiency of the system.

It was determined that the high cable losses associated with the foam filled coaxial cable used between the radio and the antenna was the most important factor in reducing the systems communication range. To overcome the high cable losses, a passive reflector 4 feet by 4 feet was fabricated and mounted on the AB-577 antenna mast. The standard horn antenna illuminated the reflector from the ground, close to the transmitter thus saving more than 100' of cable and removing equipment to be maintained from the tower to the ground. A comparison made between the reflector and the horn on top of the tower indicates that the reflector performs as efficiently as the horn. The reflector weighs much less than the horn and cable thus improving the erection time considerably.

TASK NUMBER: 02-P-73

TITLE: Unintentional Radiation

AUTHORIZED FUNDING: \$71,990

TASK DURATION: 24 July 1972 to 1 April 1974

CONTRACTOR: Honeywell, Inc.

DESCRIPTION AND RESULTS: The objective of this task was to obtain field measurement data and identify the source of unintentional EM radiation emitted from Army tactical targets, and to determine if the concept of target detection by monitoring unintentional radiation is feasible. Measurements were conducted using frequency spectrum analysis equipment to monitor EM radiation as a function of target type, age, status (stationary, moving) and auxiliary equipment. The basic field data provides sufficient input to allow predictions of system performance and formulation of use concepts.

TASK NUMBER: 03-P-73

TITLE: Artillery Location Radar

AUTHORIZED FUNDING: \$298,585

TASK DURATION: 31 July 1972 to 15 March 1974

CONTRACTOR: Westinghouse Electric Corporation

DESCRIPTION AND RESULTS: The scope of this task included modification of a contractor-owned AN/TPS-61 radar to optimize its performance in the role of detecting and rapidly locating hostile artillery. Location was accomplished by backtracking the projectile path to its source. The AN/TPS-61 radar, developed by the contractor for the detection of low-flying aircraft, was evaluated along with the US Marine Corps AN/TPQ-31 mortar location radar. Initial tests were conducted at Naval Weapons Laboratory, Dahlgren, VA, using 81 mm mortar and 5-inch guns. More extensive tests were performed at Ft. Sill, OK, using both radars against 4.2" mortar, 105, 155, 175 mm and 8" guns. These tests determined first round and "n" round weapon location accuracies and provided a data base for recommendations to improve radar performance. Test results show that the AN/TPS-61 performance was superior to that of the AN/TPQ-31 and that the AN/TPS-61 could serve the dual purpose of locating artillery and vectoring aircraft to the target area.

B-475

TASK NUMBER: 04-P-73

TITLE: Aerial Reconnaissance Binoculars

AUTHORIZED FUNDING: \$41,318

TASK DURATION: 14 August 1972

DESCRIPTION AND RESULTS: The objective of this task was to design, develop, fabricate and test a low-power, lightweight, pocket size binocular. Studies on target acquisition and surveillance by an airborne observer indicate that for optimum performance optical sights should have a 2 to 4 power magnification, a wide field-of-view and a large exit aperture to retain the target even when hindered by the vibration of the aircraft.

A low-cost binocular which is lightweight, nonmechanized, low power (2-4 power), and has wide field-of-view (approx 25°), wide exit aperture (approx 10 mm) and high brightness was designed. Evaluation was in progress at the time of termination.

B-476

TASK NUMBER: 05-P-73

TITLE: Automatic Distance Indicator (ADI)

AUTHORIZED FUNDING: \$90,020

TASK DURATION: 10 January 1973 to 1 April 1974

CONTRACTOR: Westinghouse Electric Corporation

DESCRIPTION AND RESULTS: The objective of this task was to develop and fabricate for MASSTER test three ADI systems. The device consists of a set of boot antennas and one small (ammo pouch) control/readout unit. The system measures the distance traveled by the operator and displays the distance traveled while accommodating step length variations of from 10-40 inches.

B-477

TASK NUMBER: 06-P-73

TITLE: Line Intrusion Detector

AUTHORIZED FUNDING: \$77,082

TASK DURATION: 11 January 1973

DESCRIPTION AND RESULTS: This development combines a commercial microwave intrusion alarm with balanced signal processing and a leaky, single wire antenna to detect moving targets within a 6-10 foot distance from the wire. Preliminary experiments demonstrated the feasibility of the approach and established 915 MHz as a suitable frequency. Tests showed that targets can be detected along several hundred feet of wire strung either indoors or outdoors, around corners, behind walls and next to fences. The limited range and blocking by walls and fences minimize false alarms from friendly activity nearby and within a perimeter; the balanced processing avoids alarms from foliage, fans, power lines and other similar sources. The 6-8 foot range prevents tampering or efforts to jump over or dig under the system.

Modification of a commercial microwave system was completed. This equipment will serve as transmitter/receiver for the system. Experimental evaluation of candidate antennas (radiating wires) was completed in October 1973. The system was then made available for evaluation for perimeter security application.

TASK NUMBER: 07-P-73

TITLE: Reduced Size Aerial Reconnaissance Platform

AUTHORIZED FUNDING: \$206,224

TASK DURATION: 20 February 1973

CONTRACTOR: Windecker Ind., Inc.

DESCRIPTION AND RESULTS: This task provides for the flight testing of a small, low cost, lightweight, fiberglass RPV (remotely piloted vehicle) built under LWL task GNI 02-PA-73. The technology used to fabricate this RPV was developed by Windecker Industries and is used in the Windecker Eagle, the first all fiberglass FAA type certified airplane. This new type of fiberglass chemistry which was evaluated under the Plastic Airplane Task, 10-P-72, has been shown to enable the fabrication of low cost, lightweight airframes with low observable signatures, and significantly lower performance degradation by projectile impacts.

The airframe was completed in June 1973. A contract was then let to provide for the flight testing. Coordination was accomplished with AAVSCOM. The task was still open upon deactivation.

B-479

TASK NUMBER: 01-P-74

TITLE: Universal Ground Surveillance Radar

AUTHORIZED FUNDING: \$2,786

TASK DURATION: 24 July 1973 to 6 February 1974

DESCRIPTION AND RESULTS: A study was conducted to determine the feasibility of combining into one system different techniques now used for long-range surveillance, foliage penetration and target classification (tracked vs wheeled vehicles, fixed vs rotary aircraft).

B-480

TASK NUMBER: 02-P-74

TITLE: Structural Composite Armor

AUTHORIZED FUNDING: \$41,000

TASK DURATION: 24 July 1973

CONTRACTOR: Windecker Ind.

DESCRIPTION AND RESULTS: A new high modulus fiberglass developed by Windecker Industries offers the potential of a low radar cross section armor with a savings in size and weight over conventional composite armor techniques. Tests at Ft. Eustis on sections of the Windecker plastic aircraft using this type material show it to be relatively free of spallation. If this material can be made in a transparent form, the potential exists for transparent armor. Small samples of both transparent and opaque armor will be fabricated for ballistic tests and radar reflection coefficient tests. Optical characteristics of the transparent samples will be measured. The task was still in progress upon termination.

B-481

TASK NUMBER: 03-P-74

TITLE: CAVNAV Emergency Light Filters

AUTHORIZED FUNDING: \$868

TASK DURATION: 6 July 1973 to 31 January 1974

DESCRIPTION AND RESULTS: Testing of the CAVNAV system at MASSTER and LWL showed that the aircraft warning lights are so bright when they are activated that they interfere with the pilot's vision.

A filter to reduce the intensity of the warning lights was developed and tested at LWL. The filter still allows sufficient light through to allow the pilot to notice that the light has been activated while wearing the Night Vision Goggles. The requirement requested 5 sets of filters for the warning lights on the AH-1, UH-1 and OH-58 aircraft.

TASK NUMBER: 04-P-74

TITLE: Improved Corps Communications (USAREUR)

AUTHORIZED FUNDING: \$12,500

TASK DURATION: 5 November 1973

DESCRIPTION AND RESULTS: Field tests revealed that the problem areas of antenna erection, foliage interference and transmission line losses can be significantly improved upon through two approaches. These approaches involve short-term, quick-fix hardware improvements and a longer-term investigative effort. In the short term area, modifications are made to the antenna mast crank assembly; the method used for implanting guy wire stakes is improved, and transmission line monitoring devices and methods are used. Replacement of the present transmission line and connectors may be needed to minimize mechanical and electrical difficulties. In the longer-term investigation, the use of a passive reflector within the antenna system will be considered along with improved types of mixer crystals and very low-loss, low-paper transmission lines and techniques.

Hardware modifications described above will be assembled into a test configuration and made available with technical support, to USAREUR for a field trial. This task was still open at the time of deactivation.

TASK NUMBER: 20-P-74

TITLE: RMA Magnetometer Evaluation

DESCRIPTION AND RESULTS: Rocky Mountain Arsenal provided funding for LWL participation in a magnetometer search for buried waste materials for Rocky Mountain Arsenal, CO. Since these targets resemble tunnels and/or caches, the LWL Tunnel/Cache Detector was considered to be an appropriate detector for this search operation.

The Phase I RMA evaluation was completed. A search of a sample area disclosed several potential target locations. Laboratory analysis of soil samples was used to confirm target locations.

B-484

TASK NUMBER: 23-P-74

TITLE: Underwater Ferrous Target Detector (NEOD)

DESCRIPTION AND RESULTS: An existing cesium vapor magnetometer was modified for underwater use by a diver. The system is used to detect ferrous targets. One UFTD was delivered and technical assistance provided during evaluation by NAVEODFAC at Indian Head, MD, which was still in progress at the time of deactivation.

TASK NUMBER: 01-B-63

TITLE: Personnel Detection (Biological)

AUTHORIZED FUNDING: \$549,163

TASK DURATION: 13 December 1962 to 11 July 1967

CONTRACTORS: Animal Behavior Enterprises, Inc.; General Atronics; Biosearch;
University of Maryland

DESCRIPTION AND RESULTS: Perform research to establish the feasibility of detecting personnel in concealed positions utilizing biological techniques. Among the techniques to be given consideration are: a. Use of trained dogs; b. Use of trained birds.

A general requirement for any detection method was that it be capable of functioning under a variety of environmental conditions and have an effective range of at least 50 yards. It was shown that military scout dogs can be trained to function successfully off-leash at distances up to 200 meters and more from their handlers. It was also shown that an alert signal, given by a dog upon detecting a human being, can be transmitted to the handler by a radio link.

In the bird training program racing homing pigeons were trained to work in an ambush detection system. A military potential test of the system was cancelled and the contract was terminated when pigeon pox incapacitated the birds. The system was to consist of twelve birds carried in coops mounted on a 3/4 ton truck. Minature radio transmitters were provided for the pigeons to carry in flight. At the time the work ended, the contractor had not satisfactorily resolved two basic behavioral problems peculiar to the requirements of the system: obtaining reliable flight behavior in unfamiliar territory and dependable control of birds in no-target as well as in target situations.

B-486

TASK NUMBER: 02-B-63

TITLE: Anti-Materiel System

AUTHORIZED FUNDING: \$54,170

TASK DURATION: 19 December 1962 to 28 February 1964

DESCRIPTION AND RESULTS: The description of this task was classified SECRET.
It was terminated prior to completion.

TASK NUMBER: 03-B-63

TITLE: Physiological Effectiveness of TEA

AUTHORIZED FUNDING: \$75,896

TASK DURATION: 12 December 1962 to 12 April 1965

CONTRACTOR: University of Cincinnati

DESCRIPTION AND RESULTS: Tri-ethyl aluminum is a pyrophoric compound which ignites spontaneously in air and detonates in the presence of water. In order to determine the usefulness of this compound as an anti-personnel agent, controlled laboratory tests with clothing and standard test card materials and surface applications on animals to determine the physiological effects were performed. Through field testing with simulated human targets, the laboratory data were extrapolated to give estimates of human incapacitating effectiveness of prototype munitions for limited war use.

Experimental work under this contract was described in detail in a four-part final report, entitled, "An Investigation of the Physiological Effects of Pyrophoric Agents to Evaluate their Anti-Personnel Efficacy (U)". In Part I the effects of 1/2 ml quantities of tri-ethyl aluminum (TEA) on test cards, rabbits and pigs, with and without clothing materials, were determined. In Part II, similar determinations were made with tri-isobutyl aluminum (TIBA) and a solution of tri-ethyl aluminum in mineral oil (OATS). Part III, the effects on animals (pigs and rabbits) of 1/2 ml quantities of the alkyl aluminum agents were compared with those of comparable quantities of napalm-thickened gasoline, white phosphorous and an experimental West German red phosphorous mixture known as HGR ZDM52. In Part IV, experimental determination was made of the smallest quantity of OATS (solution of TEA in oil) that will cause a 3rd degree burn in the skin of rabbits and pigs. It was found that as little as 5 microliters (.005 ml) will produce a 3rd degree burn when applied to the bare dry skin of these animals. The area of burns produced by 5 microliters of OATS ranged from 0.22 cm² in rabbits to 0.30 cm² in pigs.

The relative physiological effectiveness of TEA, TIBA, OATS, white phosphorous and napalm-thickened gasoline was also evaluated. It was concluded that tri-ethyl aluminum can be ranked first with respect to four of six critical parameters for which data were available.

B-488

TASK NUMBER: 04-B-63

TITLE: Leech Repellent

AUTHORIZED FUNDING: \$64,288

TASK DURATION: 9 January 1963 to 22 November 1965

DESCRIPTION AND RESULTS: Conduct an investigation of leech repellent properties of selected compounds. It was required that the repellent formulations protect effectively against aquatic as well as terrestrial leeches. It was also desirable to incorporate in the same formulation agents that would provide some degree of protection against infection, and, if possible, promote wound healing.

A non-toxic, water insoluble formulation consisting of 25% diethyltoluamide and 75% USP lanolin for surface application was developed. Small quantities rubbed on the skin and into clothing will provide protection against terrestrial and aquatic leeches even following repeated immersion in water. 10,000 units were shipped to RVN.

TASK NUMBER: 05-B-63

TITLE: Personnel Discrimination Device

AUTHORIZED FUNDING: \$7,744

TASK DURATION: 17 March 1963 to 16 February 1965

DESCRIPTION AND RESULTS: Develop for field use a device which will correctly identify, with a minimum of 85% assurance, at least 70% of the Viet Cong in groups in which there are 10 or more Viet Cong. This was to be accomplished with an acceptable level of assurance that loyal Vietnamese in such groups would not be identified as Viet Cong. It was planned to adapt lie-detection techniques to the screening of large numbers of people. Discrimination was to be possible in a first-stage interrogation. The need to devise means of interrogation other than direct verbal questioning, for example, by presentation of visual material, was to be investigated.

Preliminary investigations before cancellation of the task centered on (a) defining the essential military requirements for a rapid screening interrogation system to meet tactical and operational needs; (b) assessment of current state-of-the-art of interrogation procedures; (c) consideration of sociological and psychological factors that can be expected to have a direct impact on the success and effectiveness of the proposed system.

TASK NUMBER: 06-B-63

TITLE: Ambush Prevention by Area Denial

AUTHORIZED FUNDING: \$1,858

TASK DURATION: 1 April 1963 to June 1964

DESCRIPTION AND RESULTS: Conduct research on non-lethal contamination of the environment for the purpose of providing a means for the prevention of ambushes. Certain obvious techniques, for example, application of CS, were not considered. The concepts that were studied included: (1) the application or dissemination of an agent or agents that will excite local animal populations to a degree sufficient to cause extreme discomfort, harassment or immediate threat to humans in the area, and (2) dissemination of quantities of minute, nearly invisible, semi-encapsulated, highly irritating material of animal or plant origin. Areas judged to be potential ambush sites would be seeded with these items.

In-house study of the concepts described above indicated that the technical problems involved in either approach are well within the bounds of contemporary knowledge and scientific and industrial capabilities. The work scope was then transferred to Task 01-B-64.

B-491

TASK NUMBER: 07-B-63

TITLE: Applications of Animal Attractants

AUTHORIZED FUNDING: \$1,009

TASK DURATION: 1 April 1963 to January 1964

DESCRIPTION AND RESULTS: Determine the feasibility of utilizing substances to promote contamination, spoilage and deterioration of food and other susceptible materiel by pests. Preliminary in-house study of this problem indicated that two approaches should be thoroughly investigated in a coordinated contractual and in-house program. One approach was the possibility of employing "fly factor" as a means of promoting contamination by flies (diptera). A second approach involved the use of cockroach sex attractant in various ways, including promoting contamination and for personnel marking and identification. The work scope was then transferred to 01-B-64.

TASK NUMBER: 10-B-63

TITLE: Lightweight Water Purification Unit

AUTHORIZED FUNDING: \$27,792

TASK DURATION: 23 May 1963 to 14 April 1967

DESCRIPTION AND RESULTS: To design, fabricate and test a lightweight water still for field use. A new concept involving use of all-plastic components will be tested. The desired unit would weigh under 6 pounds empty; would produce adequate quantities of high-quality distilled water from locally available fuel and could be packaged in a compact, air-droppable bundle.

A lightweight, all-plastic still weighing less than six pounds when empty, which produced 1 to 2 quarts per hour of high quality distilled water from turbid, brackish or saline sources was developed. The still is intended to use locally available fuel. The boiler is a 6 inch-diameter, 4 foot tube of fiberglass fabric impregnated with silicone rubber. When filled with water, the boiler can be heated directly in a wood fire. The water level in the boiler can be maintained by addition of raw water during operation through a specially designed filling valve. Distillate is condensed by air cooling, in plastic tubing. Filled lengths of condenser tubing can be tied and cut off for convenient transport of distillate.

An order for twelve production prototype units was placed with a commercial source. Water production and quality tests of the production prototypes were completed.

B-493

TASK NUMBER: 11-B-63

TITLE: Individual Water Filtration Device, Collapsible Canteen System

AUTHORIZED FUNDING: \$49,442

TASK DURATION: 31 July 1963 to 13 July 1965

CONTRACTOR: DAI Corporation

DESCRIPTION AND RESULTS: Develop a water filtration device and compatible collapsible canteen for individual use. The water filter should be capable of removing particulate material greater than 10 microns in diameter. The usable life of the filter is directly related to the particulate content of the water that is passed through it.

An all-plastic filtration unit incorporating a positive displacement pump was developed. With a Pall Corporation Ultipor 2-filter cartridge as the final filter and a glass-wool pre-filter attached to the inlet, this unit is capable of filtering 4 to 5 gallons of heavily silted water (mud) and up to 30 gallons of natural pond water containing organic as well as inorganic particulate material.

Because of redefinition of the requirement, operational evaluation of the filter pump unit by the Tropical Test Center, Fort Clayton, Canal Zone, was cancelled and the task terminated. Following termination of this task a Quick Reaction Requirement formulated by certain U. S. forces in Vietnam for 1350 units was approved by ACSFOR. The APG Procurement Office was assigned responsibility for procurement of these units based on specifications provided by LWL.

TASK NUMBER: 01-B-64

TITLE: Entomological Applications in Counterinsurgency

AUTHORIZED FUNDING: \$34,957

TASK DURATION: 10 October 1963 to 16 September 1966

CONTRACTOR: Cornell University

DESCRIPTION AND RESULTS: The objective was to exploit insects and substances produced by insects in offensive and defensive applications to counterinsurgency. Wasps, bees, and ants are abundant in many environments, especially in tropical regions. These insects are excited to a high level of aggressive behavior by the presence of minute amounts of alarm substances which provoke the insects to make fierce attacks on any invaders of the area. Selective seeding of potential ambush sites with frangible micro-containers filled with the alarm substance, which would be released when the containers are crushed or broken, may be an effective means for denying such sites to human occupancy. The trigger agent would be virtually undetectable by an enemy.

These studies tended to confirm results reported in the literature concerning the stimulatory effect of various compounds on bees and ants.

TASK NUMBER: 02-B-64

TITLE: Instrumented Biosensors

AUTHORIZED FUNDING: \$131,433

TASK DURATION: 10 October 1963 to 6 July 1967

DESCRIPTION AND RESULTS: An experimental study was conducted of the biosensing capabilities of several kinds of arthropods, including bedbugs, the giant cone-nose bug, ticks, fleas and mosquitoes. A portable personnel detector using the giant cone-nose bug (*Triatoma infestans*) was designed, fabricated and tested. The final prototype device consisted of a chamber containing half a dozen adult bugs enclosed within a bellows-type air pump. The bugs were in contact with a wire mesh that was connected to a phono pick-up through an amplifier. Sound made by the bugs in moving on the wire mesh was amplified and could be monitored with earphones. In field tests conducted in Florida, and the Panama Canal Zone, significant increases in activity-generated sound were obtained under conditions that indicated apparent detection of a single individual as far as 35 yards upwind. Unwanted increases in activity also occurred, and with sufficient frequency to introduce some uncertainty as to the validity of the results. Subsequently, well-controlled laboratory experiments showed that motion alone stimulates the bugs to heightened activity, and that "spontaneous" activity cycles can be correlated with exposure to light and darkness.

In other experiments, a considerable amount of data was accumulated that suggests that mosquitoes, caged in a device, may be peculiarly well-suited to serve as nocturnal intrusion detectors. In this role, the equipment would be statically emplaced to detect the presence of approaching personnel.

TASK NUMBER: 03-B-64

TITLE: Applications of Selected CW Agents in Unconventional Warfare

AUTHORIZED FUNDING: \$24,717

TASK DURATION: 10 October 1963 to 23 November 1965

CONTRACTOR: The Travelers Research Center

DESCRIPTION AND RESULTS: A study was conducted to define situations in unconventional warfare in which selected, non-lethal, incapacitating agents might be utilized with significant effect against personnel. Data relating to numerous non-lethal incapacitating agents were accumulated. Unconventional warfare situations were analyzed in detail for the purpose of defining specific modes of employment for agents of this kind. Concomitantly, a review of agents was conducted to match appropriate agents with desired uses. Methods of agent dissemination were studied and prototype items designed, fabricated and tested. The program was closely coordinated with the USA Chemical Research and Development Laboratories, Edgewood Arsenal.

B-497

TASK NUMBER: 01-B-65

TITLE: Animal Utilization Studies

AUTHORIZED FUNDING: \$86,985

TASK DURATION: 3 August 1964 to 13 April 1967

CONTRACTOR: Animal Behavior Enterprises, Inc.

DESCRIPTION AND RESULTS: Work was completed to determine the load carrying capabilities, both external and internal, of various species of mammals and birds. The contractor devised a variety of functional tests, tailored to the characteristics of the different species, to measure work performance under various loads. Some difficulties and delays were experienced in obtaining and using certain exotic species, but these were mostly overcome and all the contract objectives were met. An in-house effort was initiated to explore problems relating to the control and guidance of animals under field conditions. An instrumented in-door arena was constructed to provide a restricted field situation.

TASK NUMBER: 02-B-65

TITLE: Investigation of New Incendiary Agent

AUTHORIZED FUNDING: \$86,348

TASK DURATION: 3 August 1964 to 13 April 1967

CONTRACTOR: University of Cincinnati, Kettering Laboratory

DESCRIPTION AND RESULTS: The purpose of this task was to assess the anti-personnel and anti-materiel effectiveness of magnesium teflon formulations. The physical properties of various formulations were correlated with their physiological effects in tests with animals.

The contract was completed and the contractor's final report received during the 3rd quarter FY66. The results reported by the contractor show that aspirin tablet-shaped pellets of magnesium-teflon 3/8" x 1/4" produce 3rd degree burns in the abdominal skin of rabbits and pigs.

Dynamic tests indicated that pellets of a given size when fired from an air gun at an average velocity of 65 f/s at pigs and rabbits produced 3rd degree burns in 70% of the rabbits whether the pellet adhered or not and in 50% of the pigs under similar circumstances. The remaining burns were 2nd or 1st degree burns.

The results were of sufficient interest to stimulate additional work to determine the effects of directional explosive dissemination of various sizes and shapes of mag-teflon pellets. Preliminary tests indicated that a 47 grain mag-teflon pellet might be useful in a counterambush weapon. A prototype weapon was fabricated consisting of 6, 14 inch aluminum tubes, ID of 3", each containing 200, 47 gr mag-teflon pellets with 300 grains of black powder.

B-499

TASK NUMBER: 01-B-66

TITLE: Lightweight Entomological Survey Kit

AUTHORIZED FUNDING: \$33,298

TASK DURATION: 15 September 1965 to 14 April 1967

CONTRACTOR: Insect Control & Research, Inc.

DESCRIPTION AND RESULTS: A compact, lightweight kit to contain all items necessary for the collection, identification, preservation and shipment of arthropod disease vectors v survey personnel operating in remote regions. The equipment is carried in a nylon bag 9" x 7" x 3-1/2" in size, that is fastened to the belt.

Thirty-five kits were assembled. Twenty (20) were delivered to the Office of the Surgeon General for test and evaluation. Six (6) kits were given to the Navy for evaluation in RVN. The Surgeon General was the designated parent agency.

TASK NUMBER: 02-B-66

TITLE: Personnel Marking, Non-Chemical

AUTHORIZED FUNDING: \$331,927

TASK DURATION: 23 August 1965 to 18 September 1970

CONTRACTOR: Atlantic Research Corporation, Division of Susquehanna Corporation

DESCRIPTION AND RESULTS: The purpose of this project is to explore parameters of coding techniques using magnetic markers. Compatible materials will be selected and application techniques devised.

A feasibility study was completed and a contract awarded for work on a prototype. That work was classified SECRET-NOFORN.

B-501

TASK NUMBER: 03-B-66

TITLE: Portable Surgical Light

AUTHORIZED FUNDING: \$40,974

TASK DURATION: 26 August 1965 to 14 April 1967

CONTRACTOR: Crouse-Hinds Company

DESCRIPTION AND RESULTS: A light to be used to conduct surgery in remote areas. This light, including rechargeable battery, is housed in a fiberglass case 11-1/2" x 7" x 15" and weighs 18-1/2 lbs. The light operates for more than 6 hours continuously before requiring recharge. The light assembly has its own stand or can be suspended. It can be carried in the mountain rucksack or parachutist's bag and can be assembled or disassembled within three minutes.

Three prototypes were fabricated and delivered to USALWL. Two of these were turned over to the Office of the Surgeon General for evaluation in accordance with an agreement with TSG. The 3rd prototype was kept at USALWL where checks were made to confirm that its performance met the specifications. The item was type classified Std. A.

TASK NUMBER: 04-B-66

TITLE: Biointerference Studies

AUTHORIZED FUNDING: \$22,803

TASK DURATION: 15 September 1965 to 13 February 1967

DESCRIPTION AND RESULTS: An experimental study was conducted to determine the feasibility of interfering with cane sugar production by the introduction of biological materials into the manufacturing process. Three materials were evaluated: 1) a bacterium (Leuconostoc sp.) which produces gelatinous dextrans that foul mill equipment and prevents sugar crystallization, 2) an enzyme preparation (trade name, Saccharosa) which rapidly converts the desired end-product sucrose into undesired invert sugar, and 3) benzyldiethylammonium benzoate (BEDAB) which imparts an unpalatable bitter taste to the sugar.

Pilot plant testing was conducted during two Louisiana grinding seasons at the Audubon Sugar Factory at Louisiana State University, Baton Rouge, La. During the 1965 grinding season, it was determined that contamination by Leuconostoc is not sufficiently effective to offer a feasible method. During the 1966 season, the enzyme technique was explored. It was found that Saccharosa is effective when applied to the standing cane in the field in sufficient concentration or when applied in sufficient amount to the refining process inside the mill. In addition, it was demonstrated that BEDAB applied during the extraction and refining process in the mill appeared in the end-product to make the sugar unpalatable.

B-503

TASK NUMBER: 05-B-66

TITLE: Antipersonnel Effectiveness of New Polymer Fuel

AUTHORIZED FUNDING: \$255,714

TASK DURATION: 30 November 1965 to 2 October 1968

CONTRACTOR: Miller Research Corporation

DESCRIPTION AND RESULTS: Test and evaluate the antipersonnel effectiveness of a large area coverage incendiary device (LACI) under a variety of conditions of terrain, ground cover, and weather. Develop lethal area (P_k) figures for personnel incapacitation.

Field evaluation of the 30 pound LACI under conditions similar to SEA was completed in Nov 67. Data from CONUS and OCONUS tests were analyzed and P_k and lethal areas of the device calculated. A field demonstration for interested Army agencies and activities was presented on 23 May 68.

TASK NUMBER: 06-B-66

TITLE: Tunnel Denial

AUTHORIZED FUNDING: \$165,845

TASK DURATION: 3 December 1965 to 14 April 1967

DESCRIPTION AND RESULTS: A means for long term (2 to 6 months) denial of VC tunnels utilizing standard riot control (non-lethal) chemical agents. Two approaches were investigated. (1) Dissemination of agent as a fog, and (2) dissemination of glass microcapillaries filled with agent.

The results of field tests provided the basis for a recommendation that CA be authorized as a tunnel denial agent. However, this recommendation was withdrawn in favor of a modified CS developed at Edgewood Arsenal. Additional tests were performed using a silicone-treated form of CS in methylene chloride; preliminary results indicate that the tunnel ambient temperature and presence of moisture may be critical factors influencing the effectiveness of the agent.

Studies of agent-filled glass microcapillary effectiveness were hampered by lack of a satisfactory dispersal technique. The glass microcapillaries in bulk quantities tended to clump into baseball-size masses, and could not be dispersed as a cloud of single fibers by a standard Mity-Mite blower. A breakthrough in this problem was achieved when it was found that with a comparatively simple mechanical modification to the Mity-Mite, clumps of glass microcapillaries can be drawn through the high-speed impeller where they are forced apart and expelled as a cloud consisting largely of single fibers.

B-505

TASK NUMBER: 01-B-67

TITLE: Mass Screening Techniques

AUTHORIZED FUNDING: \$91,879

TASK DURATION: 25 August 1966 to 20 August 1969

CONTRACTORS: Behavior Systems Inc.; American Institutes for Research

DESCRIPTION AND RESULTS: A study was conducted to determine the feasibility of the mass spectrometer to detect and discriminate among various human effluents with the ultimate goal of employing this or similar techniques to detect concealed personnel.

The feasibility study was completed with very favorable results. The study indicated that a human signature does exist in the mass spectrum and that it should be detectable with the aid of a newly developed separating filter.

TASK NUMBER: 02-B-67

TITLE: Canine Detection of Mines

AUTHORIZED FUNDING: \$334,363

TASK DURATION: 23 August 1966 to 23 June 1969

CONTRACTOR: Behavior Systems Inc.

DESCRIPTION AND RESULTS: The mine dog is a non-aggressive war dog that has been trained to detect and respond to land mines and to trip wires, and to various types of ordnance items as well as to the individual components (i.e., powder, metal, plastic, etc.) of such items. These dogs work in the off-leash mode for maximum efficiency, about 100 meters ahead of the handler. They can be used either on point for units travelling on winding foot paths or on road-sweeping operations. The dog's motivation for finding mines and trip wires is based primarily on food reinforcement.

Two squads of handler/dog teams of the 60th Infantry Platoon, Scout Dog, completed training at Fort Gordon, Ga., and were deployed to SEA on 20 April 1960 for a 6 month operational evaluation. Continental Army Command was the designated parent agency.

B-507

TASK NUMBER: 03-B-67

TITLE: Off-Leash Scout Dog Training

AUTHORIZED FUNDING: \$57,976

TASK DURATION: 3 August 1966 to 11 July 1967

DESCRIPTION AND RESULTS: A program was conducted to train and evaluate off-leash scout dog teams (dog and handler = 1 team) in which the dog is equipped with a motion sensing radio transmitter to enable it to function out of sight of the handler, if required.

Four off-leash scout dog teams completed basic and advanced scouting training at Fort Benning Ga., and the Ranger Camp, Eglin AFB, Fla. Basic training consisted of the standard 12 week scout dog training course developed by the 26th Infantry Platoon, Scout Dog, at Fort Benning, with early and continuing emphasis on off-leash patrolling and alerting. Off-leash training was based on procedures developed and tested at the University of Maryland Canine Behavior Laboratory. Advanced training consisted of long-range, off-leash scouting with emphasis on radio monitoring of the dogs. Advanced training was culminated in patrolling exercises undertaken with Ranger trainees at the Ranger Camp, Eglin AFB. Following completion of training, the teams were deployed to Vietnam where they were assigned for operational evaluation to the Infantry Platoon, 25th Scout Dog attached to the 1st Air Cavalry Division.

B-508

TASK NUMBER: 04-B-67

TITLE: Plant Absorption Study

AUTHORIZED FUNDING: \$13,849

TASK DURATION: 12 December 1966 to 1 December 1967

CONTRACTOR: Miller Research Corporation

DESCRIPTION AND RESULTS: An experimental study was conducted to determine whether certain compounds, when applied to soil, are absorbed by selected test plants to make the plants and/or their products unusable. Compounds that are known to be non-injurious and non-toxic to humans, and preferably of natural origin, were tested.

B-509

TASK NUMBER: 05-B-67

TITLE: Reverse Osmosis Water Purification

AUTHORIZED FUNDING: \$32,807

TASK DURATION: 13 February 1967 to 30 October 1968

CONTRACTOR: General Dynamics

DESCRIPTION AND RESULTS: The Reverse Osmosis Unit weighs 55 pounds with gasoline engine and 85 pounds with 110V electric motor. It may produce up to 100 gpd of potable water by removing over 85% of dissolved salt with each pass. Brackish water with 10,000 ppm dissolved salt can be made potable by using two passes. The unit produces 32 lbs of potable water per lb of fuel using 4,500 ppm saline water feed. The unit measures approximately 2 ft long x 1 ft wide x 1 ft high.

Engineer Testing was conducted on the unit at Fort Belvoir from Oct 67 to Apr 68. Two units were shipped to Vietnam in Apr 68 for operational evaluation and were used by the 5th Special Forces Group in the Can Tho area of the delta.

B-510

TASK NUMBER: 06-B-67

TITLE: Enzyme Study

AUTHORIZED FUNDING: \$66,754

TASK DURATION: 17 April 1967 to 5 August 1969

CONTRACTOR: Susquehanna Corporation

DESCRIPTION AND RESULTS: A feasibility study was conducted to determine whether individuals or particular ethnic groups can be identified by unique characteristics of enzymes present in urine. A study was made of enzymes present in urine and indicator enzymes have been selected. A study of urine samples from a population of varying genetic background and a study of urine samples from genetically homogeneous populations were completed.

B-511

TASK NUMBER: 01-B-68

TITLE: Canine Detection of Tunnels

AUTHORIZED FUNDING: \$242,502

TASK DURATION: 14 July 1967 to 27 June 1969

CONTRACTOR: Behavior Systems Inc.

DESCRIPTION AND RESULTS: The tunnel dog is a non-aggressive war dog that has been trained to detect and respond to underground cavities and also to trip wires. These dogs work in the off-leash mode for maximum efficiency from 20 to 50 feet ahead of the handler. When the dog picks up the scent of an underground dead air space, it will, unless otherwise directed by his handler, approach the target at a rapid trot and sit, usually within two feet of it. Under most conditions, the dogs will be able to search three to five acres per hour. The dog's motivation for finding tunnels and trip wires is based primarily on food reinforcement.

Two squads of handlers and dogs of the 60th Infantry Platoon, Scout Dog, completed training at Fort Gordon, Ga., and deployed to SEA on 20 April 1969 for a 6 month operational evaluation. Continental Army Command was the designated parent agency for this item.

B-512

TASK NUMBER: 03-B-68

TITLE: Off-Leash Scout Dog Radio System

AUTHORIZED FUNDING: \$16,788

TASK DURATION: 23 August 1967 to 5 August 1968

DESCRIPTION AND RESULTS: The scout dog radio transmitter developed by the USALWL was modified to eliminate a number of deficiencies and short-comings that field experience revealed in the earlier model. Principally, the batteries were placed in a compartment separate from the circuitry, so that batteries can be replaced without opening the circuit compartment. The antenna was redesigned to eliminate the breakage problem that was encountered in the earlier model. Additionally, the transmitter case was fabricated from aluminum rather than plastic, and it, as well as the antenna, was designed to be mounted on a standard dog harness rather than requiring a special harness.

A validated ENSURE Request for this system was assigned to the designated parent agency, USAECOM. An initial quantity of ten radio systems for training purposes was procured for the 26th Infantry Patrol, Scout Dog, Fort Benning, Georgia. Delivery of these units was made in Jun 68.

B-513

TASK NUMBER: 05-B-68

TITLE: Waste Disposal Unit

AUTHORIZED FUNDING: \$15,188

TASK DURATION: 5 December 1967 to 3 September 1969

DESCRIPTION AND RESULTS: This is a small (4' x 2' x 2') plastic septic tank system designed to replace the "Honey bucket" and pit latrines for field use. The kit comes complete with the necessary piping and hardware, is easily installed and requires no maintenance.

Two units were installed and operated satisfactorily at Fort Dix, New Jersey. Fifty units were shipped to RVN for field evaluation.

B-514

TASK NUMBER: 06-B-68

TITLE: Leech Repellent Evaluation

AUTHORIZED FUNDING: \$7,534

TASK DURATION: 28 February 1968 to 5 August 1968

DESCRIPTION AND RESULTS: Leech repellent, developed by the USALWL, consists of a mixture of one part diethyltoluamide (DEET) and three parts USP lanolin. Ten thousand bottles of leech repellent were procured to replace an equal quantity provided by the 5th Special Forces to ACTIV for evaluation by the 9th Infantry Division and the Americal Division. The 10,000 bottles of leech repellent obtained by the USALWL were shipped to RVN in Jun 68. The U. S. Army Natick Laboratories was the designated parent agency for this task.

TASK NUMBER: 07-B-68

TITLE: Remote Area Refrigeration Unit

AUTHORIZED FUNDING: \$12,629

TASK DURATION: 12 March 1968 to 13 February 1969

DESCRIPTION AND RESULTS: The primary objective of this task was the development of a reliable, portable, non-electric refrigerator under 5 cu ft capacity for support of Special Forces, Military Training Teams and Civic Action programs in areas where electricity is not available.

Cooling is supplied by a heat absorption system; heat is provided by a kerosene fueled burner unit or alternatively, by 110 V, 60 cycle AC or 12 Volt DC heating element. In areas where electricity cannot be provided, liquid fuel such as kerosene, methanol or JP-4 fuel can be used. Flame may be lit and will function normally in 25 mph winds. Temperature lowering time (40-44°F) is 2.5 hours at average room temperature. This unit is commercially available, requiring only minor modification for the proposed use.

Five units were evaluated in Vietnam, four in Africa, three in South America, and one by the Surgeon General.

TASK NUMBER: 08-B-68

TITLE: Hand-Held CS Generator (RC)

AUTHORIZED FUNDING: \$9,402

TASK DURATION: 22 April 1968 to 30 October 1969

DESCRIPTION AND RESULTS: Two small commercially available insecticide foggers have been adapted for use as CS generators for use in this system. One (Dyna-fogger) operates on the resonant pulse jet principle using gasoline as the fuel. The other (Minifogger) uses propane gas as the fuel. Both thermally vaporize CS from a solution.

Continental Army Command evaluated these devices. Results in preliminary tests indicated effectiveness at ranges up to 500 meters downwind.

B-517

TASK NUMBER: 01-B-69

TITLE: Thin Film Plastic Utility Kit

AUTHORIZED FUNDING: \$9,852

TASK DURATION: 31 July 1968 to 3 June 1969

DESCRIPTION AND RESULTS: The Plastic Utility Kit consists of two components:

- a. Pouch or container - 6 mil polyvinyl chloride (PVC) with OD-printed surface.
- b. Tube - 6 mil, 6' x 10" flat body PVC film with OD-printed surface.

Overall size of the complete kit is 4" x 5" x 3/4", including information manual. Twenty-eight hundred kits were shipped to RVN in June 1969 for operational evaluation.

B-518

TASK NUMBER: 02-B-69

TITLE: Blood Pressure Recording Device With Visual Readout

AUTHORIZED FUNDING: \$35,652

TASK DURATION: 8 August 1968 to 17 February 1971

DESCRIPTION AND RESULTS: This device is similar to a conventional sphygmomanometer. However, it differs from conventional instruments by having a visual readout of both systolic and diastolic pressures that eliminates the need for the operator to listen for the Korotkov sounds with a stethoscope. The device consists of two components, a pressure component and an electronic component. Because the device operates directly from the blood pressure and has a visual readout, its use is not limited by high ambient noise and vibration nor by the discriminative hearing ability of the operator. Four systems were evaluated by USA Surgeon General and one system by the U.S. Air Force Aeromedical Space Center, Brooks Air Force Base, Texas.

TASK NUMBER: 03-B-69

TITLE: Improved Water Analysis Kit

AUTHORIZED FUNDING: \$50,227

TASK DURATION: 20 August 1968 to 10 April 1973

DESCRIPTION AND RESULTS: This kit includes tests for water quality. Most of the tests are performed with so-called dip strips, which may be either a strip of treated paper, such as for measurement of pH or hardness, or a capillary strip as for measuring chloride and alkalinity. The paper strips produce a color change which is compared to a color chart which indicates the quantitative value. With the capillary strips a graduated capillary column changes color to a height related to the concentration of the material being determined. The quantitative value is determined by referring the column height read from the graduated scale to a table. The LWL kit was evaluated by the USA Environmental Hygiene Agency in comparison with several commercial test methods. The LWL dip strips were rated superior to all other methods with respect to simplicity and ease of manipulation, but on the basis of accuracy and precision in each case, one or another kit was found to be better than the LWL kit. Since accuracy and precision were the prime consideration, none of the LWL components were recommended for inclusion in the Water Quality Analysis Set. USAEHA recommended continued development of these components.

TASK NUMBER: 04-B-69

TITLE: Rapid Tests for Pathogens in Water Supplies

AUTHORIZED FUNDING: \$114,545

TASK DURATION: 20 August 1968 to 15 January 1973

CONTRACTOR: Susquehanna Corporation

DESCRIPTION AND RESULTS: The USALWL pathogen test kit employs a unique procedure based on an original concept and it is designed to make rapid field determinations of the presence in water of bacteria such as Salmonella, Shigella and E. coli. Definitive results can be obtained in six hours or less as compared to 24 to 36 hours for standard bacteriological techniques. The technique employed here is to demonstrate the presence of bacteriophages (bacterial viruses) that specifically infect each type of bacteria. A direct quantitative reaction between the number of phages found and the number of bacteria present in a given water sample has been established for E. coli. An improved prototype kit has been developed which contains enough material to examine ten water samples for each of three organisms in the field.

B-521

TASK NUMBER: 05-B-69

TITLE: Small Mammal Collection Kit

AUTHORIZED FUNDING: \$25,177

TASK DURATION: 20 August 1968 to 9 November 1970

DESCRIPTION AND RESULTS: The Small Mammal Collection Kit is intended to supplement standard equipment. It is designed to enhance the effectiveness of preventive medicine surveys involving live trapping of medically important small mammals and the collection of their ectoparasites. Materials and tools are supplied for the field fabrication of 60 rat traps. A unique attachment, 100 of which are provided in each kit, converts any beer can into a live trap for field mice. An aspirator facilitates handling of ectoparasites by functioning by blowing rather than by sucking. Mist nets are provided on non-tangle frames for collecting bats.

B-522

TASK NUMBER: 06-B-69

TITLE: Lightweight Hamster Frame and Cage

AUTHORIZED FUNDING: \$16,674

TASK DURATION: 20 August 1968 to 6 August 1970

DESCRIPTION AND RESULTS: The lightweight hamster frame and cage provides a means of backpack transport of 100 mice or 100 weanling hamsters to and from remote areas for the purpose of performing epidemiological surveys that involve the injection of freshly collected samples into the animals. The equipment consists of a standard rucksack to which a frame is attached that can hold either 20 mouse cages (plastic pints) or 20 hamster cages (extended plastic pints). Each cage accommodates five animals for a period of up to 21 days. The equipment is lightweight, easily cleaned and the animals are accessible for care and feeding. Six units of the prototype were made available for operational evaluation in Malaya, Thailand and Panama through coordination with the Walter Reed Army Institute of Research.

B-523

TASK NUMBER: 07-B-69

TITLE: Immediate Non-Lethal Incapacitation

AUTHORIZED FUNDING: \$70,309

TASK DURATION: 20 August 1968 to 10 June 1969

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The purpose of this task was to design, fabricate and test a prototype hand-held weapon to fire a low-velocity projectile to produce immediate, non-lethal incapacitation by mechanical impact. This task was cancelled after 6 months. The contractor completed preliminary ballistic and animal tests, the results of which provided baseline data for design of a prototype projectile/launch system. The data indicated that this weapon might have too many limitations to fulfill present requirement.

TASK NUMBER: 08-B-69

TITLE: Off-Leash Tracker Dog - Helicopter Tracking Team

AUTHORIZED FUNDING: \$43,937

TASK DURATION: 22 August 1968 to 10 September 1969

DESCRIPTION AND RESULTS: Black Labrador Retrievers were trained to track personnel while off-leash and monitored via a small transmitter by personnel in a helicopter. The dogs stalk rather than overrun the target, thus enabling the helicopter to locate the target by DF/ing on the dogs radio signal.

Results showed that Labrador Retrievers can be trained to follow a complex track and also stalk a target without overrunning it. It was also shown that a dog on the ground carrying a small radio transmitter can be located within practicable limits from an airborne helicopter by means of the helicopter's radio DF/ing equipment.

B-525

TASK NUMBER: 09-B-69

TITLE: Prototype LACI System

AUTHORIZED FUNDING: \$287,016

TASK DURATION: 2 October 1968 to 8 May 1970

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: The LACI (Large Area Coverage Incendiary) is a prototype air-droppable incendiary munition that utilizes magnesium teflon pellets as the incendiary fill. A single prototype munition weighs approximately 30 lbs of which 25 lbs is incendiary payload. The LACI is designed to be released from a specially designed dispenser that attaches to standard bomb shackles on the AH-1G or UH-1 aircraft. Two dispensers, each carrying three LACI's, can be mounted on the outboard stores stations; the inboard stations can be utilized for conventional weapons. An extensive program of field test/evaluation was completed in CONUS and OCONUS (Hawaii) and two prototype dispensers and forty LACI's were delivered to LWL.

TASK NUMBER: 10-B-69

TITLE: Analysis for Lead

AUTHORIZED FUNDING: \$66,577

TASK DURATION: 9 October 1968 to 9 November 1970

CONTRACTOR: NRA, Incorporated

DESCRIPTION AND RESULTS: The LWL lead detection kit was designed for field use to detect trace quantities of lead on personnel. Lead on a person's skin or clothing may mean that the person has recently fired a weapon. The test utilizes a highly sensitive colorimetric reaction of a solution of dithizone reagent.

One thousand kits were sent to RVN for evaluation and sixty kits were sent to Fort Bragg for evaluation by Military Police. Review of certain evaluation results indicated that, where use of the kit was ineffective, the user may have failed to comprehend exactly the intended use and limitations of the kit. Positive results were reported by some users with an indication that the kits will be used operationally when and if the opportunity arises. Since no formal military requirement was initiated for the lead analysis kit, the task was terminated.

TASK NUMBER: 11-B-69

TITLE: Detection of Concealed Weapons at Close Range

AUTHORIZED FUNDING: \$17,833

TASK DURATION: 16 October 1968 to 11 September 1970

DESCRIPTION AND RESULTS: The Transfrisker is a commercial, transistorized, portable metal detector capable of detecting both ferrous and non-ferrous metals. Detection is indicated by a squealing sound from the loudspeaker when the search wand portion of the unit is brought into the vicinity of the metal or when a small sample of metal is passed over the flat side of the wand. A small coin (such as a U.S. dime or U.S. cent) is detected at approximately two inches (five centimeters) from either flat surface of the search wand and a gun at five or six inches (12 to 15 cm). A large steel plate is not detected beyond 24 inches (60 cm) from a flat side of the wand or 15 inches (37 cm) from one edge of the wand. The detector has been designed to use readily available batteries.

The technique for using the detectors to locate metal objects is very important. In order to reduce false alarms to a minimum, each device should be held no closer than four to five inches from the individual being searched. Items picked up at one inch or less are usually too small to be useful as weapons. Operating the device with the proper technique should increase the number of individuals processed during searching of personnel passing through check points and in and out of secure areas.

TASK NUMBER: 12-B-69

TITLE: Conversion of Waste to Power

AUTHORIZED FUNDING: \$4,501

TASK DURATION: 13 November 1968 to 8 May 1969

DESCRIPTION AND RESULTS: The objective of this task was to determine the feasibility of adapting the known technique of converting sewage to methane gas and using the methane as fuel to provide power in relatively primitive environments.

A study of various techniques for providing electrical energy (engine, fuel cells) was completed. The study was inconclusive with respect to the stated objective of the task.

TASK NUMBER: 13-B-69

TITLE: Effectiveness of a Dual Purpose Anti-Parsonnel Munition

AUTHORIZED FUNDING: \$59,749

TASK DURATION: 9 January 1969 to 27 March 1970

CONTRACTOR: Northrop Corporation

DESCRIPTION AND RESULTS: The dual purpose munition consists of a LACI (Large Area Coverage Incendiary) device into which approximately 20 1"x1" CS canisters, developed by Edgewood Arsenal, have been incorporated with the magnesium teflon incendiary fill. Field test/evaluation showed that a significant amount of CS is released from the canisters following air drop of the prototype munition. Incapacitating concentrations of CS were recorded over most of the 5000 square meter target grid.

TASK NUMBER: 14-B-69

TITLE: Vehicle Tracking Transmitter (RC)

AUTHORIZED FUNDING: \$9,741

TASK DURATION: 27 February 1969 to 27 March 1970

DESCRIPTION AND RESULTS: Under a former LWL task, a small 450 Mw FM radio transmitter was developed for use with off-leash scout or tracker dogs.

The purpose of the present task was to establish the feasibility of another use concept for the existing transmitter. Under this task, a procedure was established by which a particular vehicle could be located in an urban area. This vehicle would first be "tagged" by attaching the FM transmitter in an inconspicuous place such as under the bumper or on the frame of the vehicle. Then, knowing a general area in which the vehicle would be located at a later time and by employing radio DFing techniques with appropriate receiving equipment, the vehicle might be located precisely.

In extensive field testing it was shown that with a few limitations this premise was valid. One could locate a tagged vehicle even while it was parked in a multi-story garage, although the range at which the signal could be detected was short - one city block or less. It appeared not to be possible to locate a vehicle in a closed garage with a high density of metal.

The best results in tests performed under this task were obtained using portions of the so-called Cafe Blue system (AN/VRQ-4 (XE-1(V)) mounted on an M151A1 1/4 ton truck.

Under test conditions, signal reflections presented some problem initially but could be compensated for by using an average direction. The transmitted signal was received generally at distances of 5 to 6 city blocks, in densely built-up areas. Thus, an operator can in fact search an area of 10 or 12 city blocks diameter at one time. Since the searching vehicle is in motion the operator does not establish a fixed azimuth but rather only a general direction. An ever-decreasing square search pattern therefore can be used to pin-point the source of the signal. With practice, a technique can be developed that will expedite the searching procedure.

TASK NUMBER: 15-B-69

TITLE: Use of LACI on Oil Slicks

AUTHORIZED FUNDING: \$699

TASK DURATION: 14 April 1969 to 10 September 1969

DESCRIPTION AND RESULTS: The LACI device, weighing 30 pounds, contains approximately 7,000 1/2 x 1/4 inch mag-teflon pellets that burn in excess of 3,000 degrees K. The LACI device will be dropped on oil slicks from the LACI dispenser and impact detonated. Up to six LACI's per sortie can be dropped in this manner either singly or in tandem.

TASK NUMBER: 16-B-69

TITLE: Replacement Mine Detector Dog/Handler Teams

AUTHORIZED FUNDING: \$351,934

TASK DURATION: 27 May 1969 to 4 June 1970

CONTRACTOR: Behavior Systems, Inc.

DESCRIPTION AND RESULTS: This task was a part of the mine detector dog program described in detail in the main body of this report under Task Execution.

B-533

TASK NUMBER: 17-B-69

TITLE: Reverse Osmosis Evaluation

AUTHORIZED FUNDING: \$10,235

TASK DURATION: 6 June 1969 to 20 November 1970

DESCRIPTION AND RESULTS: Reverse osmosis provides a method of desalinating brackish water by separating water molecules from salt ions through a semi-permeable membrane. The USALWL equipment is capable of desalinating approximately 100 gal of brackish water in a 24-hour period. This equipment is designed to provide desalinated water from brackish sources to small field units such as Special Forces A teams or Military Assistance Command advisory teams, in permanent or semipermanent base camps. The Office of the Scientific Advisor to the Military Assistance Command, South Vietnam, requested USALWL to refurbish two RO units that had been returned to LWL from RVN following an earlier incomplete evaluation for reevaluation by MACSA. This was done, and certain non-standard accessory equipment was procured.

B-534

TASK NUMBER: 01-B-70

TITLE: Explosives Detecting Dogs

AUTHORIZED FUNDING: \$70,072

TASK DURATION: 30 August 1969 to 13 May 1971

CONTRACTOR: University of Mississippi

DESCRIPTION AND RESULTS: These dogs were trained to detect TNT, dynamite (nitro dynamite, ammonium nitrate), black powder, C3, and C4. They were also trained to search buildings and to make a sit response upon detecting the odor of any of these explosives. Major effort was directed toward developing reliable search behavior and detection of dynamite and black powder.

This task was completed on 30 Apr 71 when three trained dogs were delivered to the Military Police School, Fort Gordon for evaluation and two dogs were delivered to the New York Police Department also for evaluation. The purchase and training of the dogs for the New York Police Department was funded by the Law Enforcement Assistance Agency of the Department of Justice.

TASK NUMBER: 02-B-70

TITLE: Nightstick Search Device for Riot Control

AUTHORIZED FUNDING: \$9,984

TASK DURATION: 30 August 1969 to 11 September 1970

DESCRIPTION AND RESULTS: The MK-4 nightstick search device is a military modification of a commercially available nightstick magnetometer that is capable of detecting concealed weapons at close range (18 inches or less). This device is strong enough to be used as a conventional nightstick. A built-in meter gives silent detection. Slow changes in meter reading indicate overall field variations; fast meter jumps signal the presence of weapons or other ferrous metal items. This is a ferrous metal detector (iron and steel) only and is not suitable for use in searching for general contraband.

Ten nightsticks modified for military usage were procured. Five were delivered to XVIII Airborne Corps for a 30-day evaluation. The other five units were offered to CONARC for evaluation.

TASK NUMBER: 03-B-70

TITLE: Application of Voice Analysis Method

AUTHORIZED FUNDING: \$121,795

TASK DURATION: 9 October 1969 to 6 October 1973

CONTRACTOR: Fordham University; Decision Control, Inc.

DESCRIPTION AND RESULTS: There is evidence that emotional stress elicited in a subject under interrogation is reflected in vocal energy parameters. The objective of the present task is to develop an instrumented procedure by means of which selected vocal parameters of a subject's responses to questions can be analyzed either directly during interrogation or from a tape recording of the interrogation. Changes in the peak amplitudes in two frequency bands provide a variable ratio that may be a valid and reliable indicator of attempted deception. The significant indices are the numerical values of the ratios obtained for the various responses and hence a determination of possible deception can be made directly and quantitatively without requiring the exercise of subjective interpretation. Limited tests of a prototype system with responses in Hebrew and Arabic indicate that it is applicable to languages other than English.

The prototype voice analysis system, including an interrogation protocol as well as the analysis instrument, was tested for validity, accuracy and reliability in comparison with the conventional polygraph at Fordham University. The results showed that the system is not an acceptable substitute for the conventional polygraph.

B-537

TASK NUMBER: 04-B-70

TITLE: Specialized Mine Detector Dog

AUTHORIZED FUNDING: \$89,690

TASK DURATION: 29 October 1969 to 23 July 1971

CONTRACTOR: Animal Behavior Enterprises

DESCRIPTION AND RESULTS: Dogs were trained to detect plastic antipersonnel mines (M14) buried in soil. The effort was directed toward providing a detection capability for application in areas such as the Korea DMZ where it is desired to recover M14 mines from very old mine fields.

R-538

TASK NUMBER: 05-B-70

TITLE: Portable Dog Kennel

AUTHORIZED FUNDING: \$16,954

TASK DURATION: 2 February 1970 to 12 October 1970

DESCRIPTION AND RESULTS: The portable dog kennel is intended to provide suitable shelter for a military dog and, if needed, to serve as emergency confinement quarters for a suspect rabid dog. This kennel is easily and quickly foldable for transport or storage. It can be stump-punted to lift it off the wet ground, or it can be set directly on a hard stand.

The kennel roof is of aluminum reinforced with paper construction. The screening, floor and storm door are aluminum. The kennel weighs about 80 pounds.

Ten prototype kennels were shipped to RVN in 2nd Quarter for evaluation by Military Police units. The task was then terminated.

TASK NUMBER: 06-B-70

TITLE: Multi-Purpose Dog

AUTHORIZED FUNDING: \$189,235

TASK DURATION: 4 August 1970 to 30 June 1973

CONTRACTOR: Southwest Research Institute

DESCRIPTION AND RESULTS: The special conditions of warfare in Southeast Asia resulted in a proliferation of specialized military dogs, including scout dogs, mine detector dogs, tunnel detector dogs and sentry dogs. Under this task the feasibility of training individual dogs, each to perform all of these functions plus attacking on command, was established. The training accomplished under this task was directed specifically toward developing a multi-purpose dog for use with infantry in small unit patrol/reconnaissance operations. Certain fundamental concepts relating to the training and employment of "infantry" dogs, pioneered in the US Army by USALWL in developing the off-leash scout dog and the mine, boobytrap and trip-wire detector dog, were applied. Thus, for a number of very good reasons, food reinforcement was used as the principal training tool. A predictable result of using this training technique is to de-emphasize the dog-handler relationship and to facilitate interchangeability of handlers and dogs. This is important in a combat environment in which the handler-dog team generally operates in the most hazardous position in unit operations. Dog-handler fixations, as well as handler avoidance behaviors, are eliminated to a large degree by minimizing the use of punishing contingencies in training. Another USALWL-pioneered concept that found application in developing the multi-purpose dog was the emphasis on off-leash performance. All of the multi-purpose dog functions except tracking are performed off-leash.

Five trained multi-purpose dogs underwent rigorous field evaluation by the Military Dog Committee of the USA Infantry School, Ft. Benning, Ga. As a result, the dog was type classified Std A.

TASK NUMBER: 01-B-71

TITLE: Barrier Coatings for Skin

AUTHORIZED FUNDING: \$65,518

TASK DURATION: 24 July 1970 to 9 January 1973

CONTRACTOR: Gillette Company Research Institute

DESCRIPTION AND RESULTS: The objective of the present task was to find a way to prolong the effective persistence of DEET on the skin under all conditions. The approach taken was to combine DEET with a water and abrasion-resistant coating. A promising class of highly polymerized polysaccharide esters of fatty acids appeared to provide a good vehicle for DEET. Extensive testing showed that these polymers can last for extended periods of time on the skin where they form a tough, elastic film and are well tolerated and cosmetically acceptable. Formulations of polysaccharide-fatty acid ester polymers with DEET were prepared and subjected to preliminary testing both in vitro and on human volunteers.

Polymer-DEET formulas were tested against mosquitoes. Those polymers which showed the best performance in preliminary tests were formulated with medically acceptable solvents. It was finally concluded that none of the experimental formulations offered any advantage over standard mosquito repellent solution.

B-541

TASK NUMBER: 02-B-71

TITLE: Atmospheric Water Extractor

AUTHORIZED FUNDING: \$6,289

TASK DURATION: 27 July 1970 to 23 April 1971

DESCRIPTION AND RESULTS: Militarily useful quantities of water (100 gal per day) can be recovered from nominally dry (desert) atmosphere. The equipment will occupy about 50 cu ft, weigh about 800 pounds, and require about 13.4 kw of electricity. The process utilizes an adsorbent to remove water from the air. Water is recovered by heating the adsorbent.

TASK NUMBER: 04-B-71

TITLE: Improved Waste Dispos. Unit

AUTHORIZED FUNDING: \$17,854

TASK DURATION: 11 August 1970 to 1 September 1972

DESCRIPTION AND RESULTS: This is a pre-fabricated septic tank system in which all plumbing parts, including a 200-gallon tank and associated pipes, are provided. The user need only prepare a site and assemble and install the system components. Assembly of the system requires no special tools or equipment.

User evaluations were accomplished at Fort Dix, Fort McClellan, and in Korea. The results of these evaluations were generally favorable. The Corps of Engineers assigned a federal stock number to the item (FSN 4540-762-9450) and it is described in the Engineer Facilities Construction and Planning Guide.

TASK NUMBER: 05-B-71

TITLE: Dog Countermeasure Study

AUTHORIZED FUNDING: \$160,555

TASK DURATION: 13 August 1970 to 28 February 1974

CONTRACTOR: Southwest Research Institute

DESCRIPTION AND RESULTS: Field tests were conducted by the Military Dog Attachment, USAIS, Ft. Benning, GA to evaluate the effectiveness of a two-component system as a countermeasure against tracker dog teams. A total of 25 tests were performed, involving tracks varying in length from 1000 to 3000 meters. The two-component countermeasure was used in twelve of the tests. Significant effects on tracking performance were observed in only 5 of these 12 tests. Insufficient material was available to allow definitive results to be obtained. It was concluded, however, that the two-component countermeasure system may be effective if used properly under the right environmental conditions with appropriate maneuvers.

TASK NUMBER: 06-B-71

TITLE: Evaluation of the Mag-Teflon Perimeter Defense Weapon

AUTHORIZED FUNDING: \$140,524

TASK DURATION: 25 August 1970 to 28 February 1974

CONTRACTORS: AAI Corporation; Antenna Research Associates, Inc.

DESCRIPTION AND RESULTS: A one-shot, throw-away, flame fougasse utilizing mag-teflon as the incendiary fill was developed. Firing data, including area coverage and pellet distribution, were acquired and were used to estimate provisional incapacitating effectiveness.

Each unit consists of a modified LAW tube, 22 inches long, with a diameter of 2.75 inches, factory-filled with 625 magnesium-teflon pellets. Firing tests of prototype units showed that the weapon has a maximum effective range of 50 meters with a fan-shaped dispersion angle of 45°.

The concept of use for this weapon is that it can be emplaced in a perimeter as a defensive weapon, or in other appropriate tactical situations, where it can be command-fired or fired by trip-wire. Because it is cheap, small, and would come to the field completely assembled, ready to emplace and fire, multiple emplacements are practicable. In a multiple emplacement, individual weapons can be ripple-fired or fired simultaneously.

Two hundred and twenty mag-teflon perimeter defense weapons were procured in FY 73 for user field evaluation. Twenty of these units were subjected to environmental hazard tests, including impact (drop), shake and vibration, in accordance with LWL safety procedures. Twenty units were shipped to Thailand for user evaluation. One hundred and fifty units were offered to CINCUSARPAC for evaluation.

B-545

TASK NUMBER: 07-B-71

TITLE: SAIS

AUTHORIZED FUNDING: \$178,859

TASK DURATION: 25 August 1970 to 21 February 1973

CONTRACTOR: The Susquehanna Corporation

DESCRIPTION AND RESULTS: Development and testing of the Special Applications Identification System were completed in fiscal year 1972. The item is a system for permanently marking individuals in such a manner as to enable positive identification at a later date. Its description is classified.

A final report on the SAIS was distributed to various agencies in which it seemed that such a system might find a use. Although the responses generally indicated interest in the concept and the system, no agency was able to state a requirement.

TASK NUMBER: 08-B-71

TITLE: Anti-Plant Agent/Weapon

AUTHORIZED FUNDING: \$34,984

TASK DURATION: 8 October 1970 to 1 July 1971

DESCRIPTION AND RESULTS: A preliminary experiment showed that addition of small amounts of benzyl diethyl ammonium benzoate (Bitrex or BEDAB) to the soil in which tomato plants were growing resulted in the deposition of some of the additive in the mature fruit. The extremely bitter taste of BEDAB made the fruit inedible. In another experiment BEDAB was dissolved in alcohol and sprayed on the leaves of a marijuana plant (Cannabis sativa, L.). The dried leaves were unusable because of the presence of BEDAB in them.

Information derived from the present study of BEDAB absorption relates primarily to its effects on the marijuana (hemp) plant. The following data have been obtained:

- a. Concentration/time curve for BEDAB in major structural parts of the plant, i.e., roots, stem, leaves, as a function of the initial concentration in the soil and of the plant growth cycle.
- b. Minimum contamination density of BEDAB needed for the accumulation of effective levels in the plant.
- c. The extent to which and the manner in which BEDAB may affect plant growth.

B-547

TASK NUMBER: 09-B-71

TITLE: Large Remote Area Refrigerator

AUTHORIZED FUNDING: \$10,052

TASK DURATION: 3 November 1970 to 28 May 1971

DESCRIPTION AND RESULTS: This is a lightweight, multifuel-powered refrigerator that can be carried by a 1/4 ton truck when Mobile Advisory Teams (MATs) move from one location to another. Extensive modification of this refrigerator was undertaken to make the system compatible with the designated remote areas of operation. The Large Remote Area Refrigerator operates on a heat absorption principle, using liquid fuel. There are no moving parts to break down in rugged environments. Minor alterations to the interior of the refrigerator allow 50 percent of the internal volume (approximately 4.0 cubic feet) to be used as a freezer. Six Large Remote Area Refrigerators were evaluated in RVN.

B-548

TASK NUMBER: 10-B-71

TITLE: Reverse Osmosis Field Evaluation

AUTHORIZED FUNDING: \$5,459

TASK DURATION: 4 January 1971 to 23 March 1971

DESCRIPTION AND RESULTS: This task was established as a follow-on to an earlier task entitled "Reverse Osmosis Evaluation" [17-B-69]. The two reverse osmosis units described there were further modified to correct certain deficiencies noted in the course of in-house testing. When ready for shipment to RVN, each unit had a nominal capacity of 100 gallons per day and could be operated either with an electric motor or a 1.5/2.6 horsepower gasoline engine, Mil Std Model 1A08. Additionally, a floating pre-filter of unique design was provided with each unit.

Both reverse osmosis units were shipped to RVN in Jan 71. One unit was to be evaluated by an activity designated by USAMACV-CORDS (Civil Operations and Rural Development Support), and the other by the Combat Development Test Center, ARVN. The unit assigned to MACV-CORDS failed after a short period of preliminary operation and could not be made operational with the resources at hand. The unit assigned to the ARVN-CDTC was placed in operation on/about 1 Mar 71 and was operated continuously for at least 60 days.

B-549

TASK NUMBER: 11-B-71

TITLE: Leather Substitute Equipment for Military Dogs

AUTHORIZED FUNDING: \$6,189

TASK DURATION: 22 February 1971 to 25 August 1972

DESCRIPTION AND RESULTS: Military dog equipment, currently fabricated with leather (harness, muzzle, collar, leashes, etc.), can be made with leather substitute materials such as the material known as Corfam or Nylon webbing, or Dacron polyester. Several sets of equipment in which all items but the leash were fabricated with Corfam, with the leash being made of Dacron polyester, were assembled and evaluated by the Military Dog Detachment of the USA Infantry School, Ft. Benning, GA.

The results of the Military Dog Detachment evaluation were favorable and indicated the desirability of making leather substitute equipment available for Army use. Natick Laboratories was designated the parent agency, and an information package was assembled for Natick Labs as a basis for initiating action to adopt appropriate changes in the military specifications for dog equipment.

TASK NUMBER: 02-B-72

TITLE: Icy Ball Refrigerator

AUTHORIZED FUNDING: \$84,503

TASK DURATION: 11 August 1971 to 7 March 1974

CONTRACTOR: Process Prod. Inc.

DESCRIPTION AND RESULTS: The Icy Ball refrigerator consists of an insulated box with a top door, a portable generator and a cooling unit. It is an absorption type refrigerator and operates independently of any special fuel requirement, which allows its use in remote areas under primitive conditions. The system operates as follows: Each refrigerator is provided with a source of heat (kerosene burner, bottle gas burner, charcoal brazier, open fire, etc.) for the periodic recharging of the refrigerator unit. To start operation, the generator is placed over a lighted stove or any supporting fire for about 90 minutes. The cooling unit is simultaneously immersed in cold water. When the cooling unit is fully charged, it is placed inside the refrigerator box with the generator left on the outside; refrigeration will then be maintained within the box for a period of 24 to 36 hours, depending on the ambient temperature, frequency of use, etc. The Icy Ball refrigerator will operate at normal refrigeration temperatures for periods of 24 to 36 hours without recharging.

One Icy Ball system was shipped to ARPA for DTC V evaluation. Two systems were tested at the Tropical Test Center, Panama. The US Ambassador to UNESCO has expressed interest in the refrigerator for under developed countries. Natick Labs has indicated interest in a modified refrigerator for use in a mobile field kitchen.

B-551

TASK NUMBER: 03-B-72

TITLE: Tunnel Denial Study

AUTHORIZED FUNDING: \$18,959

TASK DURATION: 27 August 1971 to 1 February 1973

DESCRIPTION AND RESULTS: The method that was under investigation involved the encapsulation of one or both of the reactants whose reaction produces the riot control agent CS, and their dissemination as a binary system. The reaction to form CS would occur only when the separate reactants were released from the encapsulated condition. The study showed that the reaction to form CS will occur at a reasonable rate at ambient temperature and pressure.

The study was completed and a final report was prepared and distributed. The results were promising, but somewhat preliminary, and implementation of the method in field situations would require further work. Current priorities did not favor the continuance of the project.

TASK NUMBER: 04-B-72

TITLE: Improved Reconnoitering Capability for Military Dogs

AUTHORIZED FUNDING: \$39,100

TASK DURATION: 30 August 1971 to 28 February 1974

DESCRIPTION AND RESULTS: Experience with military dogs in Infantry operations in Southeast Asia demonstrated that they can function effectively in a variety of Infantry support roles including scouting, mine detection and tracking. With increasing emphasis on developing improved night operations capability, and also with emphasis now on a potential mid-intensity conflict, it is important to develop improved means for night employment of dogs. This task was concerned with this problem. The approach followed was to provide light intensifying binoculars, AN/PVS-5, developed by the USA Night Vision Laboratory, for use by the handler, and, at the same time, to equip the dog with an infrared illuminating device.

Infrared illuminating devices mounted on a dog harness, were delivered for test and evaluation. Each device consists of grain-of-wheat incandescent lamps with IR filters, mounted in holders attached to the harness. The light is diffused by the filters to illuminate the dog's shoulders and head. With the AN/PVS-5 binoculars, the forepart of the dog can be seen at 50 meters and more in darkness with sufficient resolution to enable the viewer to determine the dog's orientation.

TASK NUMBER: 05-B-72

TITLE: Portable Dog Kennels for MPS

AUTHORIZED FUNDING: \$4,266

TASK DURATION: 27 August 1971 to 6 January 1972

DESCRIPTION AND RESULTS: The USALWL portable dog kennel is intended to provide suitable shelter for a military dog and is of such design that it can be folded into a compact package for transport to a new location. It is designed so that virtually all parts are attached permanently to the unit.

Military Police School evaluation of the portable kennels was completed and a report received. Certain deficiencies and shortcomings were noted. Chief among these were the following: (a) the kennel is too small to accommodate the largest dogs comfortably, (b) some dogs showed reluctance to enter the kennels, (c) the floor covering was difficult to keep clean.

TASK NUMBER: 06-B-72

TITLE: Rotary Tube Spray Equipment

AUTHORIZED FUNDING: \$25,265

TASK DURATION: 10 September 1971 to 23 May 1973

DESCRIPTION AND RESULTS: The rotary-tube sprayer is designed for spraying concentrated insecticide spray formulations at ultra-low-volume (ULV) rates for mosquito control. The particle size produced is regulated by the speed at which the tubes are rotated. The sprayer can deliver 1 to 2 gph of spray in which most particles are between 5 and 20 microns in diameter. A fan blows the fine spray from the vicinity of the sprayer. The sprayer weighs 335 pounds and is powered by a 6 horsepower standard military engine. One sprayer was shipped to Fort Drum, New York, for evaluation in mosquito control. A second sprayer was tested and evaluated by the US Army Environmental Hygiene Agency, Edgewood Arsenal, MD.

B-555

TASK NUMBER: 07-B-72

TITLE: Variable Velocity Projectile Launcher (Low Lethality)

AUTHORIZED FUNDING: \$150,116

TASK DURATION: 24 September 1971 to 7 March 1974

CONTRACTOR: AAI Corporation

DESCRIPTION AND RESULTS: An experimental prototype apparatus to propel high-Q rubber balls, approximately one inch in diameter, at a rapid rate and at variable velocities, was designed and built. The probable effects of these rubber balls on humans at various impact velocities were extrapolated from test data. These data then were utilized to guide the development of prototype apparatus suitable for user test and evaluation.

The launcher concept utilizes a man-portable apparatus to propel one-inch rubber balls at variable velocities designed to harass, stun or more seriously damage either point or area personnel targets. The unit operates in either a single-shot or fully automatic fire mode, powered by a 12-volt DC battery.

B-556

TASK NUMBER: 08-B-72

TITLE: Remote Control of War Dogs

AUTHORIZED FUNDING: \$168,578

TASK DURATION: 28 September 1971 to 22 August 1973

CONTRACTOR: Westinghouse Electric Corporation

DESCRIPTION AND RESULTS: The primary objective of the proposed study was to demonstrate the operational feasibility of remotely controlling military dogs through a radio link with the dog's handler. The secondary objective of the study was to determine the operational limitations of radio equipment compatible with the system requirements.

Dogs were trained to perform all functions required by the system concept. Radio units were completed and evaluation was accomplished. Certain deficiencies were noted in the evaluation. As a result, this task was closed out and a new task, 03-B-74, was initiated to redirect the effort toward a remotely controlled scout dog using a minimal radio system.

B-557

TASK NUMBER: 09-B-72

TITLE: Military Police Explosives/Narcotics Detector Dog

AUTHORIZED FUNDING: \$3,595

TASK DURATION: 27 June 1972 to 15 September 1972

DESCRIPTION AND RESULTS: A dog was trained to search for and detect explosives and narcotics at the request of the Provost Marshal, Ft. Benning, GA. The dog was delivered to Ft. Benning in September 1972. Operational experience indicated excellent potential for general Army use. The techniques that were used to train the dog were made available to USATRADO.

TASK NUMBER: 01-B-73

TITLE: Narcotics Detector Dog Evaluation (LEAA)

AUTHORIZED FUNDING: \$2,966

TASK DURATION: 20 July 1972 to 1 March 1973

DESCRIPTION AND RESULTS: Two dogs were trained to discriminate, search for and respond to pure heroin, heroin cut with 50 percent and 75 percent of various diluents. The dogs were also trained to discriminate, search for and respond to cocaine (hydrochloride) uncut and cut 50 percent. The dogs were trained to detect the target materials when concealed in rooms, in packages, luggage, vehicles, and on persons.

During the training phase, a number of unsubstantiated comments as to the possibility of olfactory damage were made by professional trainers. This, plus normal problems such as false alerts and possible need for refresher training, required close monitoring during the user evaluation.

Operational evaluation of the two narcotics detector dogs trained for LEAA and subsequently assigned to Miami and New York City offices of the Federal Bureau of Narcotics and Dangerous Drugs was monitored. One visit was made each quarter to each operational site. No evidence of olfactory damage to either dog was noted.

TASK NUMBER: 02-B-73

TITLE: Base Perimeter Vegetation Control

AUTHORIZED FUNDING: \$67,931

TASK DURATION: 21 July 1972 to 28 February 1974

DESCRIPTION AND RESULTS: The objective of this task was to develop a physical mechanism such as sprayed plastic film, fortified burlap, or impregnated opaque plastic sheeting, for controlling/limiting the growth of vegetation in a specified area while not permanently disrupting the ecological balance of the area.

Funds were transferred to the Vegetation Control Division, Chemical Laboratory, Edgewood Arsenal, to perform the work required to accomplish this study. Phase I, in which various control treatments were applied to test flats in the greenhouse was completed with a variety of plant species being utilized. Phase II, field testing, was also completed and an interim report, as of 30 September 1973, was submitted by the Vegetation Control Division. Observations of the field test plots were continued into 4th Qtr FY 74 when a final report was to be prepared and submitted.

TASK NUMBER: 03-B-73

TITLE: Body Recovery Dog

AUTHORIZED FUNDING: \$3,383

TASK DURATION: 2 August 1972 to 2 February 1973

DESCRIPTION AND RESULTS: The objective of this task was to determine the feasibility of training dogs to locate bodies of individuals lost in military and/or civil disasters. The Military Dog Detachment, USA Infantry School, Ft. Benning, GA, undertook, with assistance from LWL, to retrain several scout dogs to search for and locate human bodies under conditions approximating those that might occur in the aftermath of a disaster. Thus, the dogs were trained to search through piles of rubble from demolished buildings, in water and deep mud, in wrecked vehicles, sanitary fills and garbage dumps. A training odor material that simulated the odor of decaying flesh was used to mark dummies hidden in the debris, mud, etc., in the training sites. A search team consists of a handler and dog. Four such teams were trained and evaluated in realistic field tests. Field evaluation was completed in January 1973. Four Body Recovery teams were maintained at Fort Benning in a stand-by status, undergoing periodic refresher training.

TASK NUMBER: 04-B-73

TITLE: Real-Time Field Measurement of Aerosols

AUTHORIZED FUNDING: \$28,503

TASK DURATION: 2 August 1972

CONTRACTOR: Insect Control & Research Inc.

DESCRIPTION AND RESULTS: Commercial particle-size measuring and counting instruments were examined for application to the problem of obtaining real-time particle size measurement of ultra-low-volume insecticidal aerosols. Design modification was accomplished to provide required performance capability and reliability. When a suitable prototype was developed, a number of devices were procured for user evaluation. Evaluation was in progress at the time of deactivation.

TASK NUMBER: 05-B-73

TITLE: Entomological Use of Lights

AUTHORIZED FUNDING: \$31,682

TASK DURATION: 2 August 1972 to 28 February 1974

DESCRIPTION AND RESULTS: The Entomology Department, US Army Medical Laboratory, evaluated the following prototype light sources for replacement of the standard battery operated incandescent lamp in the CDC mosquito light trap.

1. Chemlites (chemicaluminescent lights)
2. Betalights
 - a. Blue
 - b. Yellow
 - c. Green
 - d. White
3. Blinking miniature neon lamp.

Field tests were conducted in the Pocomo Swamp, Maryland, and the Panama Canal Zone. Test results indicate that the chemlite attracted a comparable number of mosquitos and could be economically superior to the standard battery powered incandescent lamp. All other prototype lamps are inferior in their attractant capabilities when compared to the standard light source. The blinking neon lamp developed physical problems which hindered its evaluation.

B-563

TASK NUMBER: 06-B-73

TITLE: Pesticide Pyrolysis Device

AUTHORIZED FUNDING: \$41,384

TASK DURATION: 3 August 1972

DESCRIPTION AND RESULTS: A portable, relatively low cost pyrolyzer to develop temperatures equal to or higher than those needed to pyrolyze the pesticides, by blowing fuel and air into appropriately arranged refractory materials, was designed and constructed.

Procurement and site preparation were accomplished preliminary to erecting and testing experimental pyrolyzing equipment. A quantity of surplus insecticide was obtained for use in test/evaluation of the pyrolysis equipment. It was determined that the stack effluent must be "scrubbed" to remove hydrochloric acid. A scrubber, compatible in design with the basic incineration unit, was fabricated and tested. Arrangements were finalized with USAEHA for them to test the system. Funds were transferred to AEHA for this purpose. Long delay in procuring test instrumentation caused program slippage and the task was still open upon deactivation.

B-564

TASK NUMBER: 07-B-73

TITLE: Drug Detection by an Enzyme Method

AUTHORIZED FUNDING: \$10,933

TASK DURATION: 11 August 1972 to 10 August 1973

DESCRIPTION AND RESULTS: There is a need for a simple method to screen large numbers of personnel rapidly to detect heroin users. The present methods depend on the detection of free morphine in the urine, whereas 85 percent of the morphine in the urine exists in a chemically bound state to which detection methods are not sensitive. This present study attempted to find a simple rapid technique for converting the bound to free morphine. Such a technique would make presently used morphine detection methods more sensitive and reliable.

TASK NUMBER: 08-B-73

TITLE: Insect Chemical Detection

AUTHORIZED FUNDING: \$14,979

TASK DURATION: 18 October 1972 to 25 October 1973

DESCRIPTION AND RESULTS: Fruit flies (*Drosophila melanogaster*) can be sensitized as larvae to chemicals to which they are not normally attracted. On emergence as adults, they actively seek out these same chemicals. It was proposed to test feasibility of detecting packaged drugs, hidden explosives and concealed weapons (gun oil) by sensitizing fruit flies in the larval state and subsequently releasing the adults and observing their behavior towards respective test chemicals.

Coordination with the Biomedical Laboratory, Edgewood Arsenal, was accomplished to establish a mutually agreeable working arrangement. Flies were raised at the EA entomology facility and tests were performed to determine concept feasibility. The results were disappointing, since adult flies reared on drug-containing media showed no significant preference for the drug.

TASK NUMBER: 09-B-73

TITLE: Validation of Detector Dog Training Procedures

AUTHORIZED FUNDING: \$8,396

TASK DURATION: 15 December 1972 to 19 February 1974

DESCRIPTION AND RESULTS: Work performed under LWL Tasks on Narcotics Detector Dog was concluded with publication of the training procedures developed and used by the contractor. As described in these reports, the training procedures may not be in a form that can be readily followed by an average dog trainer without technical assistance. A joint effort with the Military Dog Detachment, USAIS, Fort Benning, GA, was initiated to review and, where indicated, revise the Technical Report material. The Military Dog Detachment had earlier used one of these reports as a guide in training explosives detector dogs. Revision of the published training material was directed toward putting it into acceptable Army field manual format at a level commensurate with potential military users.

Four dogs were trained by Military Dog Detachment personnel according to the procedures outlined in the published LWL Technical Reports. The published training procedures were reviewed and, to a considerable extent, rewritten in the light of the Military Dog Detachment experience.

B-567

TASK NUMBER: 10-B-73

TITLE: Evaluation of USALWL Weather Kit

AUTHORIZED FUNDING: \$4,025

TASK DURATION: 5 April 1973 to 2 October 1973

DESCRIPTION AND RESULTS: Under GNI Task 12-BA-73, Evaluation of Weather Kit, a weather kit that weighs 2.0 lbs. and attaches to an individual soldier's cartridge belt, was assembled. The kit consists of a carrying case which attaches to the cartridge belt. Inside the case is a plastic anemometer which can measure wind speed to 65 ± 2 mph. With the anemometer is a sling psychrometer to measure relative humidity. The dry bulb of the psychrometer is also used to measure ambient temperature. A conversion slide rule is provided to determine relative humidity from wet and dry bulb temperature readings. A plastic water container is included in the kit for use with the wet bulb thermometer. A compass to measure wind direction is furnished. Weather kit components were procured for evaluation in USARAL and Fort Bragg, NC.

TASK NUMBER: 01-B-74

TITLE: Improved Field Water Quality Tests

AUTHORIZED FUNDING: \$15,817

TASK DURATION: 1 August 1973 to 5 April 1974

DESCRIPTION AND RESULTS: The LWL Improved Water Analysis Kit, developed under Task 03-B-69, exploits to a maximum extent the "dip strip" test method. In this method one simply dips a paper strip, or a small plastic strip containing the appropriate reactants along a central capillary channel into the water to be tested, observes a color change, or the distance the capillary column changes color, and by reference to a table or color comparison chart reads the corresponding concentration of the substance of interest in parts per million. Comparative evaluation of these methods to several commercially available methods indicated that the "dip strip" methods were far superior with respect to simplicity, rapidity and ease of use, but further development of their accuracy and precision was recommended. This task was addressed to that purpose. The tests were for hardness, alkalinity, chloride and sulfate. In-house lab tests with chloride dip strips showed acceptable accuracy and repeatability (precision).

B-569

TASK NUMBER: 02-B-74

TITLE: Human Waste Disposal Pyrolyzer

AUTHORIZED FUNDING: \$25,000

TASK DURATION: 1 August 1973

DESCRIPTION AND RESULTS: Under this task a latrine collection system was developed in which individual collecting units serve as a refractory chamber within which, following the insertion of a burner nozzle, the contents are pyrolyzed at high temperature with little or no air pollution or residue. User evaluation of the system was in progress at the time of deactivation.

B-570

TASK NUMBER: 03-B-74

TITLE: Remotely Controlled Scout Dog

AUTHORIZED FUNDING: \$37,000

TASK DURATION: 22 August 1973

DESCRIPTION AND RESULTS: An earlier study showed that dogs are capable of (1) off-leash excursions on roads or trails over distances of one mile or more; (2) off-leash excursions across open fields toward prominent features of their working environment for distances of at least 500 meters; (3) being controlled in their direction of movement by radio signals at crossroads and other choice points in the terrain; (4) doing the above unaccompanied by a handler. The primary objective of this study was to demonstrate these capabilities in an operational scout dog system. A secondary objective was to develop simple, automatic training methods where possible.

Two dogs were trained with semi-automatic methods. Training aids were designed and fabricated and work on the radio equipment was conducted. The task was still open at the time of deactivation.

TASK NUMBER: 04-B-74

TITLE: USALWL Weather Kit

AUTHORIZED FUNDING: \$3,300

TASK DURATION: 14 February 1974

DESCRIPTION AND RESULTS: Various low-echelon army units are being asked to provide data on atmospheric conditions in their area of operations even though these units are not equipped to measure meteorological data.

Under GNI Task 12-BA-73, Evaluation of Weather Kit, and Task 10-B-73, Evaluation of USALWL Weather Kit, a weather kit that weighs 2.0 lbs. and attaches to an individual soldier's cartridge belt was assembled. The kit consists of a carrying case which attaches to the cartridge belt. Inside the case is a plastic anemometer which can measure wind speed to 65 ± 2 mph. With the anemometer is a sling psychrometer to measure relative humidity. The dry bulb of the psychrometer is also used to measure ambient temperature. A conversion slide rule is provided to determine relative humidity from wet and dry bulb temperature readings.

Kits were delivered to USAIMA, Fort Bragg; HQS USAREUR, 3d Sqdn, 2d ACR (Border Camp) and HQS USARAL for evaluation. Reports from evaluating kits indicated high degree of acceptability for the kit. HQS ECOM, Fort Monmouth, NJ was designated as parent agency. Ten kits were assembled for delivery to R&D Coordinator, Defense Attache Office, US Embassy, SEA.

8-572

TASK NUMBER: 30-B-74

TITLE: Protective Garments for Law Enforcement Officials (LEAA)

DESCRIPTION AND RESULTS: Five copies of each of five types of protective garments were fabricated using DuPont Kevlar (formerly known as PRD-IV). The five types of garments included (1) a police coat with liner, (2) an undershirt, and (3) a vest. Ballistic tests, including determination of backface signatures, were conducted to determine the thickness of Kevlar needed in these garments to protect the wearer from various projectiles. Accelerated aging and environmental tests of sample garments were performed. Evaluation was still in progress at the time of deactivation.

B-573

TASK NUMBER: 01-Y-68

TITLE: Multisensor Intrusion Detection System

AUTHORIZED FUNDING: \$26,000

TASK DURATION: 11 August 1967 to 27 January 1970

DESCRIPTION AND RESULTS: A program of field testing of various sensor devices was completed. A total of 12 devices, including seismic, acoustic, ultrasonic, magnetic, radar, and infrared detectors, were tested in open and wooded areas at Aberdeen Proving Ground. The primary objectives of the tests were to (1) measure detection probabilities as a function of target range; (2) measure directional characteristics of the sensors; (3) obtain an indication of the false-alarm characteristics of the detectors.

B-57A

TASK NUMBER: 01-Y-69

TITLE: Study of Riot Control Problems

AUTHORIZED FUNDING: \$29,000

TASK DURATION: 5 August 1968 to 27 October 1969

DESCRIPTION AND RESULTS: This study provides a systematic analysis of some types of civil disturbances plus a survey of related developmental materiel. The major limitation of the analysis, necessitated by time and available information shortages, is its restriction to "ghetto-type" riots. However, the materiel items described are universal in their application to control of various forms of civil disturbances. The first part of the study analyzed ghetto-type riots by identifying common characteristics of a number of disturbances which have occurred in the United States and by describing the experiences of various security forces in their control efforts. The latter part of the effort was used to catalog materiel items, not already in the Army inventory, which might be useful in providing a more flexible response to the special requirements of riot control.

TASK NUMBER: 02-Y-69

TITLE: Comprehensive Law and Order Assistance Research and Development Program

AUTHORIZED FUNDING: \$200,000

TASK DURATION: 21 March 1969 to 29 June 1970

CONTRACTORS: Arthur D. Little, Inc.; Battelle Memorial Institute; General Research Corporation

DESCRIPTION AND RESULTS: The CLOARAD Program, using published data collected and analyzed by contractor teams, reviewed the full range of civil disturbance control requirements for military hardware and tactics. The Program delineated eighteen major problem areas involving hardware and tactics, and suggested criteria and potential solutions for dealing with these problems. Additionally, five areas of military policy were identified for review because of their impact on civil disturbance control methods; suggestions for possible changes in policy were also offered. The basic conclusion of the Program was that finding the best feasible solution to each control problem will require a detailed systems study supported by extensive data collection from primary sources.

B-576

TASK NUMBER: 01-Y-71

TITLE: Riot Control Data Base Maintenance (RCDBM)

AUTHORIZED FUNDING: \$16,723

TASK DURATION: 11 August 1970 to 1 April 1972

CONTRACTOR: Battelle Memorial Institute

DESCRIPTION AND RESULTS: This task was for transfer of an information collection on civil disturbances from Battelle Memorial Institute to the Tactical Technology Center (TACTEC) at Battelle and subsequent maintenance of the collection by TACTEC.

B-577

TASK NUMBER: 01-T-69

TITLE: Indianhead Howitzer, M79 Diring Device

AUTHORIZED FUNDING: \$17,500

TASK DURATION: 5 November 1968 to 12 May 1969

DESCRIPTION AND RESULTS: The M79 Firing Device provides a method of reproducing azimuth and elevation settings from a fixed location where rounds fired from an M79 grenade launcher will produce accurate results. The device is mostly constructed of aluminum and weighs 24 pounds. It has the capability of being indexed from 0 degrees to 60 degrees left and right of center in five degree increments. Elevation adjustments are provided for impact from 75 yards minimum range to the maximum range of the round in 25 yard increments. The elevation and azimuth markings are permanently imprinted on a phosphorescent tape. The phosphorescent tape assists in providing a night capability for adjusting the azimuth and elevation settings. Since the light produced by the phosphorescent tape decays over a period of time, a commercial penlight provides a simple means of rejuvenating the phosphorescent tape if necessary. This penlight has been modified by the addition of a lucite lens and blackout skirt and, when properly used, will not compromise the location of the emplacement. Four steel mounting pins are provided to emplace the device.

TASK NUMBER: 01-T-71

TITLE: Remote Sensor Plotting Board Evaluation Quantities

AUTHORIZED FUNDING: \$4,628

TASK DURATION: 23 March 1971 to 1 February 1972

DESCRIPTION AND RESULTS: The system was designed to provide a simple means to quickly and accurately plot enemy movement rate for the prediction of arrival times in target areas. Additionally, the system produces a permanent record of enemy activities and infiltration into sensor area.

The system contains a hinged plotting/board/graph capable of being calibrated to any scale. A vertical sliding horizontal bar, with a mounted sliding, swinging, clear plastic arm, permits plotting points over entire graph sheet range.

Six systems were fabricated and shipped to Ft. Huachuca in Jun 71; two units were used at Ft. Huachuca for training purposes. Four units were later shipped to Ft. Hood, Tx, for inclusion in a MASSTER Field Test Program. A pilot test was carried out (10-12 Nov 71) at Test Control Headquarters, MASSTER, and also in a forward GP tent installation. The evaluation report of the pilot test, while revealing generally good results, recommended no further tests since the system was not needed by a Mechanized Rifle Company. A resume from the originating agency, Headquarters, U.S. Army Combat Surveillance and Electronic Warfare School, Ft. Huachuca, Arizona, reported that the system met its objectives during an evaluation test at Ft. Huachuca.

The RO 376 System negates the need for the sensor plotting board if it is available. Tentatively, DA plans are for issuing the RO 376 system at battalion level only. Should small field units not be issued the RO 376, then a requirement for the sensor plotting board may still exist.

TASK NUMBER: 01-T-73

TITLE: Nonskid, All-Size Footwear Spikes

AUTHORIZED FUNDING: \$3,596

TASK DURATION: 29 August 1972

DESCRIPTION AND RESULTS: The Footwear Spikes are a two-piece strap assembly with a series of small diameter tungsten-tipped spikes molded in natural rubber. The item is designed to fit all shoe, boot, overshoe and Arctic Vapor boot sizes without adjustment. This is accomplished by proportional positioning of the spikes in the rubber strap, so that as the strap is stretched, the spikes are separated accordingly. The ends are secured by two each button snaps integral with the strap.

When worn, the spikes afford positive footing on ice-covered exterior surfaces of track or other typical vehicles. They can also be used for walking on glazed ice or hard-packed snow. Although designed primarily for use on icy surfaces, several other advantages can be realized, such as crossing large streams which contain slippery rocks or climbing large rock masses or slopes.

Two hundred and fifty pair were produced and packaged with appropriate user instructions. An Evaluation Plan and questionnaire was written.